Investigation of R.C. & Sons Paving facility impacts on Grandview neighborhood in Augusta, Maine

Maine Department of Environmental Protection
Bureau of Air Quality
17 State House Station
Augusta, Maine 04333-0017

February 2011

Contacts: Louis Fontaine, Bureau of Air Quality Compliance Manager
Daniel Twomey, Air Quality Monitoring Laboratory Manager
Melanie Loyzim, Air Toxics & Emissions Inventory Program Manager

Executive Summary

In the summer of 2010, residents of the Grandview neighborhood in Augusta, Maine lodged complaints with the Bureau of Air Quality regarding asphalt odors and requested that the Bureau conduct air quality monitoring in their neighborhood to evaluate concentrations of toxic air pollutants. The Bureau identified naphthalene and xylene as representative of odorous asphalt emissions, and established a monitoring program for those and several other toxic compounds. The Bureau did not find any compounds in excess of the Maine Center for Disease Control's ambient air guidelines when odor was present except acrolein, which exceeds guideline levels statewide. Concentrations of toxic air pollutants measured in the neighborhood during odor episodes were consistent with those measured at Maine's five other air toxics monitoring sites.

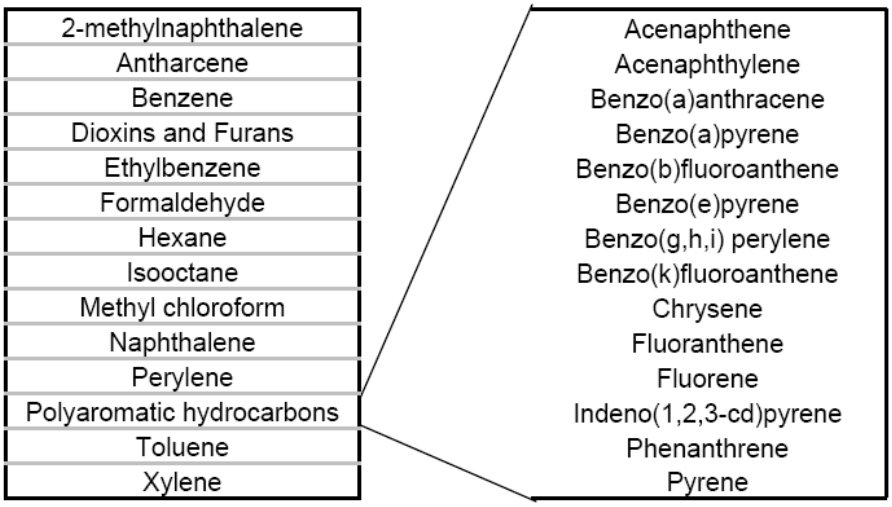
Issue and Background

Residents of Grandview Neighborhood lodged complaints with the City of Augusta and the Maine Department of Environmental Protection, Bureau of Air Quality regarding dust and odors they believe originated from the R.C. & Sons Paving operation in a gravel pit owned by McGee Construction on West River Road in Augusta. The neighborhood is located north-northwest of the operation and pit, also on West River Road. The most southerly house in the neighborhood is 1/8 mile from the northern edge of the McGee property. The entire neighborhood is within 1/2 mile of the asphalt plant, approximately 100 feet in elevation above the facilities. Homes in the neighborhood pre-date the construction of the asphalt plant and the rock crushing operation.

Quarrying and rock crushing operations at the McGee Pit where the asphalt plant is located began in 2004. These operations are subject to the provisions of License #A-886, federal standards for nonmetallic mineral processing plants ("NSPS Subpart OOO"), and several Maine air regulations including the requirement to implement Best Available Control Technology. Department staff has conducted five complete inspections of the McGee facilities since 2004, as well as numerous spot inspections. In 2005, staff received complaints about dust from the facilities and worked with the owner to institute many dust control measures. The owner paved the pit road, constructed earthen berms to obstruct mobilized coarse particles, and employs water spraying for dust suppression.

R.C. & Sons Paving is subject to the provisions of License #A-1016, filed with the Board of Environmental Protection on June 2, 2009. Licensed equipment includes a 40 million British thermal units per hour (MMBtu/hr) asphalt plant burning #2 fuel oil and waste oil, a 1.26 MMBtu/hr asphalt tank heater burning #2 fuel oil, and a 2.5 MMBtu/hr generator burning diesel fuel with a maximum sulfur content of 0.5%. The asphalt plant is equipped with a baghouse for particulate control.

According to the U.S. Environmental Protection Agency, hot mix asphalt plants emit the following hazardous air pollutants:



Initial Investigation

Residents of the Grandview Neighborhood met with DEP Field Services staff in June 2010 to express their concerns about particulates from quarrying, rock crushing and handling, and roads. They expressed greater concern, however, about chemicals associated with odors from the asphalt plant.

DEP Field Services staff conducted a full compliance inspection of the McGee facilities on June 15, 2010. No violations of License #A-886 were found. A full compliance inspection of the RC & Sons Paving facility was conducted on July 27, 2010 and no violations of License #A-1016 were found. RC & Sons Paving conducted a particulate emission test of the bag house exhaust as required by its air emission license on May 28, 2010. Measured emissions were within the facility's license limits for particulate emissions. The license for the facility does not regulate odor that may be caused by the asphalt mixing process.

The Bureau of Air Quality evaluated various monitoring strategies and determined that a standard monitoring station using methods that aggregate samples over 24-hour periods would not provide sufficient information to address complaints. Most complaints pertained to odor experienced in the morning, not throughout the day. Any short term high emission readings would be offset by times when the neighborhood was upwind of the asphalt plant and by the hours that the plant was not operating. The Bureau determined a "worst case" sampling program would be the most effective. This approach required staff to be present at the site when winds blew from the south-southeast across the site toward the neighborhood and when residents reported experiencing odors. It enabled the Bureau to evaluate air quality concentrations and determine if additional monitoring is necessary.

The Bureau put several staff on call and asked residents to call the Bureau when they noticed odors. Staff were then deployed to collect ambient air samples upon receipt of a call reporting odors. Bureau staff also visited the neighborhood on several other occasions based on weather predictions that indicated conditions could result in emissions from the site traveling across the neighborhood.

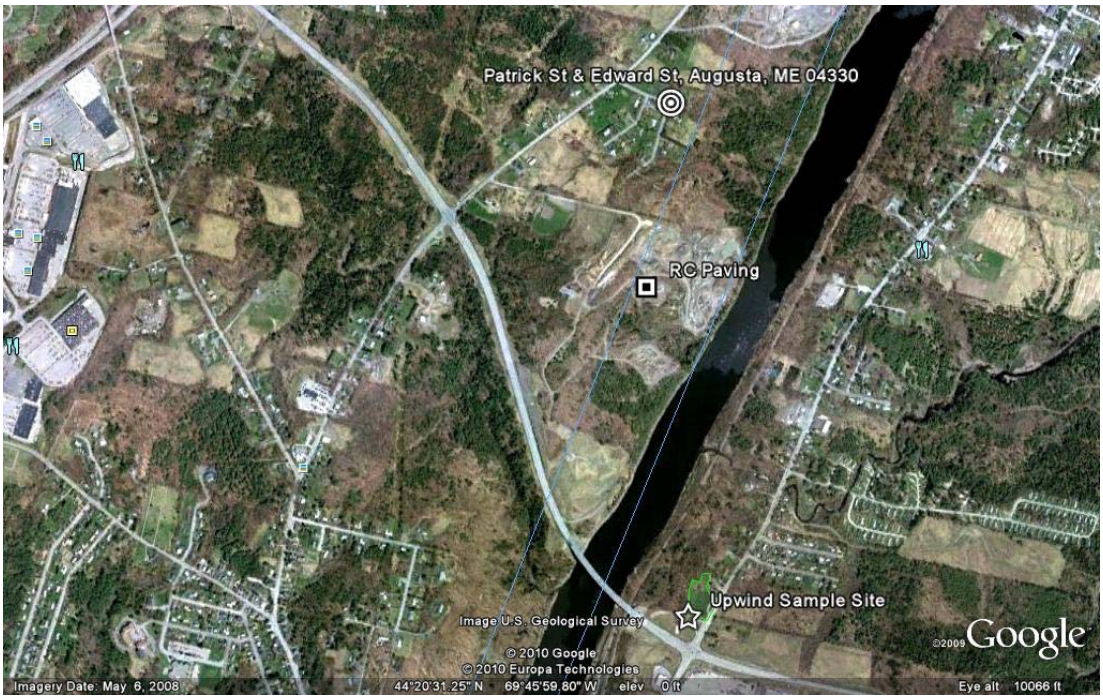
The Bureau investigated which of the hazardous air pollutants listed under Section 112 of the Clean Air Act are emitted by asphalt production operations, and more specifically those that are odorous, to determine which compounds to target for sampling. Available literature indicated naphthalene and xylene are odorous toxic pollutants typically emitted by asphalt operations. The table below illustrates how the Bureau used EPA emission factors, the facility's licensed production rate, and toxicity factors provided by the Maine Centers for Disease Control to estimate that the RC & Sons Paving facility would have much higher toxicity-weighted emissions of naphthalene and polycyclic aromatic hydrocarbons (PAHs) than the other pollutants emitted by asphalt operations. Although dioxins and furans are the most toxic of the compounds released by asphalt operations, the estimated emissions rate from asphalt mixing operations is very low (10^{-12} pounds per ton). Asphalt mixing operations emit naphthalene and PAHs at similar rates (6.5×10^{-4}

and 8.8 x 10^{-4} pounds per ton), so measurement of naphthalene also provides an estimate of the magnitude of PAHs in the ambient air from the asphalt facility.

	lb/ton	lb/hr	Emissions (ton/yr)	Toxicity Factor	**Toxicity Weighted Emissions**
total PAH HAPs	8.80E-04	0.1056	0.2281	6400	1459.81
naphthalene	6.50E-04	0.078	0.1685	6400	1078.27
2-methylnaphthalene	0.00017	0.0204	0.0441	6400	282.01
formaldehyde	0.0031	0.372	0.8035	93	74.73
phenanthrene	2.30E-05	0.00276	0.0060	6400	38.15
acenaphthylene	2.20E-05	0.00264	0.0057	6400	36.50
fluorene	1.10E-05	0.00132	0.0029	6400	18.25
benzene	0.00039	0.0468	0.1011	56	5.66
total PCDD	7.90E-11	9.48E-09	2.048E-08	271428576.00	5.56
antharcene	3.10E-06	0.000372	0.0008	6400	5.14
pyrene	3.00E-06	0.00036	0.0008	6400	4.98
acenaphthene	1.40E-06	0.000168	0.0004	6400	2.32
Total HAPs	8.70E-03	1.044	2.2550		2.26
Total PeCDD	2.20E-11	2.64E-09	5.702E-09	271428576.00	1.55
Total HpCDD	1.90E-11	2.28E-09	4.925E-09	271428576.00	1.34
fluoranthene	6.10E-07	0.0000732	0.0002	6400	1.01
Total HxCDD	1.20E-11	1.44E-09	3.110E-09	271428576.00	0.84
Total PCDD/PCDF	1.20E-10	1.44E-08	3.110E-08	22257142.00	0.69
Total PeCDF	8.40E-11	1.008E-08	2.177E-08	22257142.00	0.48
benzo(a)anthracene	2.10E-07	0.0000252	5.443E-05	6400	0.35
chrysene	1.80E-07	0.0000216	4.666E-05	6400	0.30
Total PCDF	4.00E-11	4.8E-09	1.037E-08	22257142.00	0.23
benzo(e)pyrene	1.10E-07	0.0000132	2.851E-05	6400	0.18
benzo(b)fluoroanthene	1.00E-07	0.000012	2.592E-05	6400	0.17
toluene	0.0029	0.348	0.7517	0.18	0.14
hexane	0.00092	0.1104	0.2385	0.36	0.09
Total HxCDF	1.30E-11	1.56E-09	3.370E-09	22257142.00	0.07
benzo(k)fluoroanthene	4.10E-08	4.92E-06	1.063E-05	6400	0.07
benzo(g,h,i) perylene	4.00E-08	0.0000048	1.037E-05	6400	0.07
total TCDD	9.30E-13	1.116E-10	2.411E-10	271428576.00	0.07
Total HpCDF	1.00E-11	1.2E-09	2.592E-09	22257142.00	0.06
xylene	0.0002	0.024	0.0518	0.72	0.04
Total TCDF	3.70E-12	4.44E-10	9.590E-10	22257142.00	0.02
benzo(a)pyrene	9.80E-09	1.176E-06	2.540E-06	6400	0.02
perylene	8.80E-09	1.056E-06	2.281E-06	6400	0.01
methyl chloroform	0.000048	0.00576	0.0124	1	0.01
indeno(1,2,3-cd)pyrene	7.00E-09	8.4E-07	1.814E-06	6400	0.01
ethylbenzene	0.00024	0.0288	0.0622	0.072	0.00
isooctane	4.00E-05	0.0048	0.0104	0.02	0.00

Sampling

For this project, Bureau staff measured air quality at three locations: 1) the R.C. Paving facility, 2) the Grandview neighborhood, and 3) the turnout area on the east side of the North Augusta bridge.



Bureau staff collected one sample directly from the top of the mixed asphalt silo to establish a "fingerprint" for emissions from the operation.

Staff used a portable photoionization detector (PID), calibrated for asphalt components, to take gross measurements of total volatile organic compound (VOC) concentrations. While some VOCs are also listed toxic pollutants, many are non-toxic but extremely odorous. Staff took three PID readings at the exhaust point of the mixed asphalt silo, as shown in the table below.

Date	Total VOC (ppm)
May 26, 2010	150
July 15, 2010	33
August 18, 2010	1,610

They also collected one sample from this exhaust point using a 6-liter electropolished, passivated stainless steel vacuum (SUMMA) canister in order to establish a "fingerprint" for emissions from the operation.

Staff used SUMMA canisters to collect five ambient air samples in the neighborhood when odor was reported. On three occasions staff also smelled odors characteristic of

asphalt in the neighborhood. After collecting neighborhood samples, staff also collected four upwind samples at the turnout area on the east side of the North Augusta bridge.

In September 2010, staff trained a neighborhood resident who regularly reported odor complaints in the collection of ambient samples with canisters. Staff provided the resident hands-on training, an instruction sheet, sample forms to record associated information, and sampling equipment. This would ensure that samples could be collected at the moment the resident experienced odors, in the event such odors dissipated before Bureau staff could arrive to collect a sample. Three ambient samples were collected by the resident.

The following table illustrates the sampling dates and associated field data.

Grandview Project - Air Quality Sampling

Sample Date	Sample Time	Sample Location	Sampled By	Temp °F	Wind Speed (MPH)	Wind Direction	RH	Field Notes
7/7/2010	7:35	Patrick & Edward St.	DEP	78	1-3	SSE	73%	No Asphalt Odor
7/15/2010	6:53	Patrick & Edward St.	DEP	70.3	0	none	92%	No Asphalt Odor
7/28/2010	8:31	Patrick & Edward St.	DEP	82.5	4.6	S	53%	Asphalt Odor Detected
8/18/2010	9:10	East side of Rt 3 Bridge	DEP	73.8	3.1	S	66%	Upwind
8/18/2010	9:30	Asphalt Stack	DEP	75	calm	none	66%	Batch Plant Silo
9/16/2010	15:00	Patrick & Edward St.	Citizen	-	-	-	-	Asphalt Odor Detected
9/16/2010	15:28	East side of Rt 3 Bridge	DEP	63	3-5	SE	56%	Upwind
9/22/2010	7:51	Patrick & Edward St.	Citizen	-	-	-	-	Asphalt Odor Detected
9/22/2010	8:45	East side of Rt 3 Bridge	DEP	61	4	S	67%	Upwind
9/22/2010	8:51	Patrick & Edward St.	DEP	61	4	S	67%	Asphalt Odor Detected
10/20/2010	9:54	Patrick & Edward St.	Citizen	-	5	SSW	-	Asphalt Odor Detected
10/20/2010	10:22	Patrick & Edward St.	DEP	47	3-5	S	100%	Asphalt Odor Detected
10/20/2010	10:29	East side of Rt 3 Bridge	DEP	47	3-5	S	100%	Upwind Foggy

Analysis

Based on the findings of the initial investigation, the Bureau determined that an analysis targeting naphthalene and xylene would provide a reasonable scoping estimate of toxic pollutant concentrations that may be present in the neighborhood due to the nearby asphalt operation. Staff analyzed samples collected in SUMMA canisters at the Bureau's Air Lab using gas chromatography/mass spectrometry (GC/MS) Method TO-15. This is the methodology used for the Bureau's five air toxics monitoring sites. Method TO-15 enabled the Bureau to analyze for five of the compounds emitted by asphalt batching operations (benzene, ethylbenzene, naphthalene, toluene, and xylenes), and to compare concentrations of those pollutants and several others to concentrations measured at the Bureau's regular monitoring sites.

The GC/MS unit was calibrated to detect compounds of interest at a range of 0.05 to 2.5 parts per billion volume. The lowest health-based ambient air guidelines provided by the Maine Centers for Disease Control, Environmental Toxicology Program for the five compounds analyzed is 0.06 parts per billion for naphthalene. Therefore, analysis in this range would reveal ambient concentrations just below the lowest applicable guideline level.

Results

Sampling from the exhaust point of the mixed asphalt silo revealed that acrolein is emitted in greater quantities than the other expected pollutants, which were emitted in the following order from greatest to least: xylene, naphthalene, toluene, ethylbenzene, and benzene. Acrolein is released by all exothermic reactions and should be included when EPA releases the next update to their emission factors for asphalt facilities. Other measurable pollutants included methyl chloride and ethyl chloride, which are also combustion by-products.

The Bureau compared measured concentrations of pollutants in odorous air samples to ambient air guidelines developed by the Maine CDC. None of the measured pollutant concentrations exceeded guideline levels except acrolein, which exceeds guideline levels statewide. According to the U.S. Environmental Protection Agency's 2005 National Air Toxics Assessment, acrolein levels exceed this guideline level nationwide. Acrolein is a non-carcinogenic respiratory hazard.

See **Appendix A** for analytical results for the samples collected in the Grandview neighborhood and on the east side of the Augusta bridge.

The Bureau conducted a multivariate analysis of the five target pollutants in the odor-free air and odorous air samples. This is a statistical analysis of the relationship between several variables, as compared to a simpler regression analysis using only two variables. Graphical results are shown in **Appendix B**. This confirmed naphthalene was the primary constituent associated with the asphalt odors. The analysis revealed a similar quantitative relationship between the five pollutants in the odorous air samples, and a much greater variability in the ratios of the pollutants in the odor-free samples. Even

with very low concentrations, the ratio of naphthalene to the secondary asphalt constituents – acrolein, benzene, toluene, ethylbenzene and xylenes – was higher when asphalt odors were observed. This trend is indicated by higher correlation coefficients (r) between the target compounds when the asphalt odor was present:

Naphthalene correlation (r) with odor		Naphthalene correlation (r) without odor	
Acrolein	0.9608	Acrolein	0.2882
Benzene	0.5160	Benzene	0.1447
Toluene	0.7950	Toluene	0.6268
Ethylbenzene	0.8386	Ethylbenzene	0.7249
m/p-Xylene	0.7881	m/p-Xylene	0.6999

The closer (r) is to 1, the stronger the correlation or relationship between the variables being analyzed. Although the measured concentrations for these compounds were near detection limits, their relative concentrations do indicate that asphalt odors are reaching the Grandview neighborhood.

Examining the pollutant concentrations individually, however, the measured concentrations in odorous air in the neighborhood were not significantly different than those found at monitoring sites in Portland, Auburn, Bangor, Presque Isle, and Rumford during the same sampling period from July through October 2010. **Appendix C and Appendix D** illustrate average monitored concentrations at the five air toxics monitoring sites across the state.

Conclusion

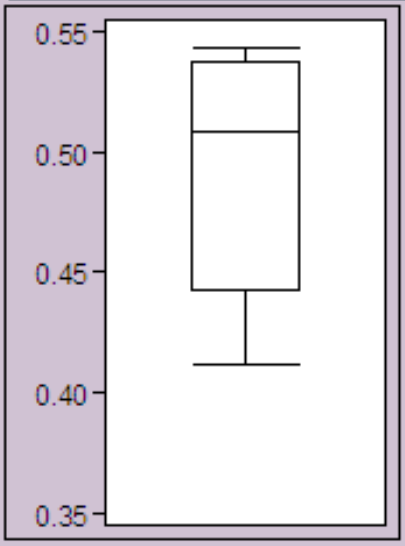
The results of the Department's air toxics monitoring in the Grandview neighborhood indicate that concentrations of toxic air pollutants are consistent with concentrations of those compounds across the state, and are below health-based guideline levels except acrolein. Despite these low concentrations, however, the ratios of asphalt-related compounds to naphthalene did subtly change when asphalt odors were present. Analyses of samples collected when asphalt odors were detected in the neighborhood indicates a low concentration (parts per billion) match to the asphalt plant.

Department staff confirmed that noticeable asphalt odors were present in the neighborhood, but did not identify any chemical above the recommended maximum ambient air concentrations that would warrant further investigation by the Department.

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Methyl Chloride 74-87-3



Quantiles

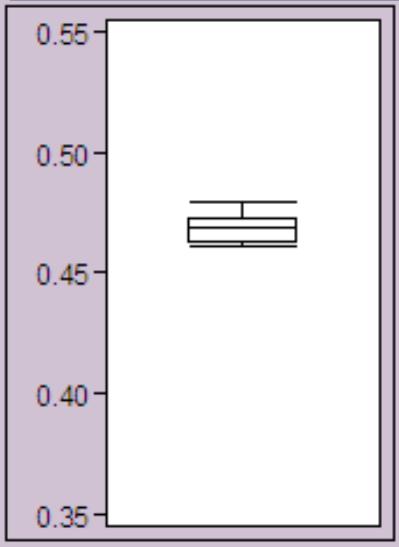
100.0%	maximum	0.543
99.5%		0.543
97.5%		0.543
90.0%		0.543
75.0%	quartile	0.537
50.0%	median	0.509
25.0%	quartile	0.443
10.0%		0.412
2.5%		0.412
0.5%		0.412
0.0%	minimum	0.412

Moments

Mean	0.493
Std Dev	0.053
Std Err Mean	0.021
Upper 95% Mean	0.549
Lower 95% Mean	0.438
N	6

Odor Detected

Methyl Chloride 74-87-3



Quantiles

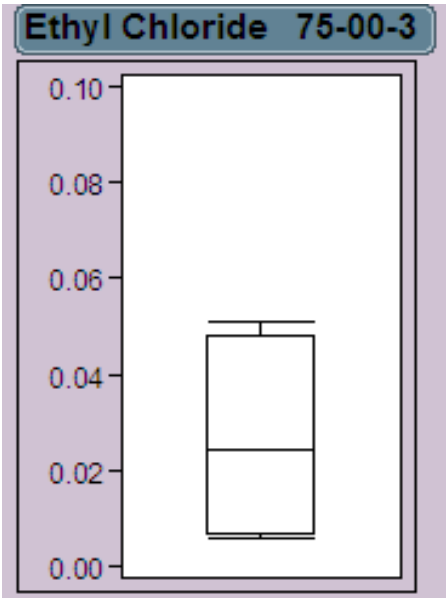
100.0%	maximum	0.479
99.5%		0.479
97.5%		0.479
90.0%		0.479
75.0%	quartile	0.472
50.0%	median	0.469
25.0%	quartile	0.463
10.0%		0.461
2.5%		0.461
0.5%		0.461
0.0%	minimum	0.461

Moments

Mean	0.469
Std Dev	0.006
Std Err Mean	0.003
Upper 95% Mean	0.475
Lower 95% Mean	0.462
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected



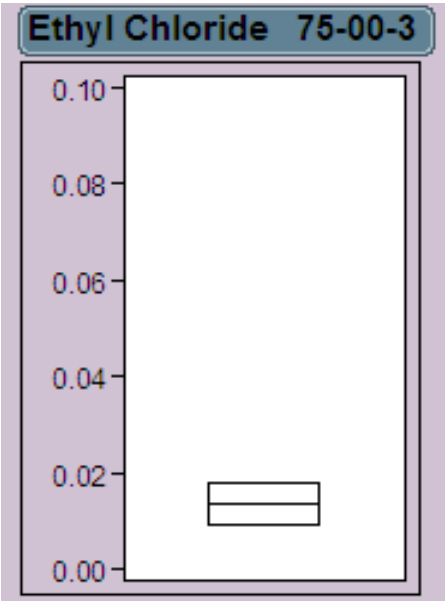
Quantiles

100.0%	maximum	0.051
99.5%		0.051
97.5%		0.051
90.0%		0.051
75.0%	quartile	0.048
50.0%	median	0.025
25.0%	quartile	0.007
10.0%		0.006
2.5%		0.006
0.5%		0.006
0.0%	minimum	0.006

Moments

Mean	0.027
Std Dev	0.022
Std Err Mean	0.011
Upper 95% Mean	0.062
Lower 95% Mean	-0.01
N	4

Odor Detected



Quantiles

100.0%	maximum	0.018
99.5%		0.018
97.5%		0.018
90.0%		0.018
75.0%	quartile	0.018
50.0%	median	0.014
25.0%	quartile	0.009
10.0%		0.009
2.5%		0.009
0.5%		0.009
0.0%	minimum	0.009

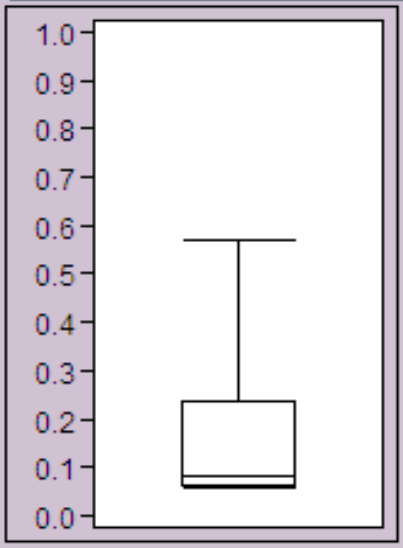
Moments

Mean	0.014
Std Dev	0.006
Std Err Mean	0.005
Upper 95% Mean	0.071
Lower 95% Mean	-0.04
N	2

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Methylene Chloride 75-09-2



Quantiles

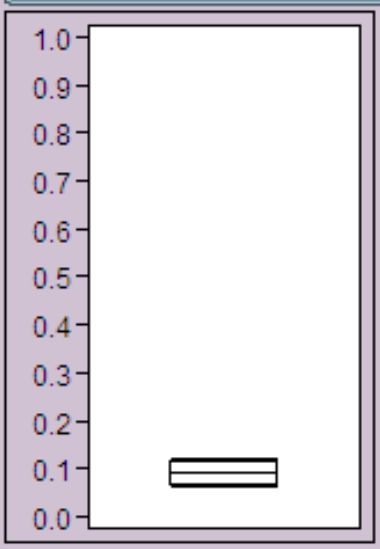
100.0%	maximum	0.569
99.5%		0.569
97.5%		0.569
90.0%		0.569
75.0%	quartile	0.235
50.0%	median	0.084
25.0%	quartile	0.062
10.0%		0.059
2.5%		0.059
0.5%		0.059
0.0%	minimum	0.059

Moments

Mean	0.164
Std Dev	0.2
Std Err Mean	0.082
Upper 95% Mean	0.374
Lower 95% Mean	-0.05
N	6

Odor Detected

Methylene Chloride 75-09-2



Quantiles

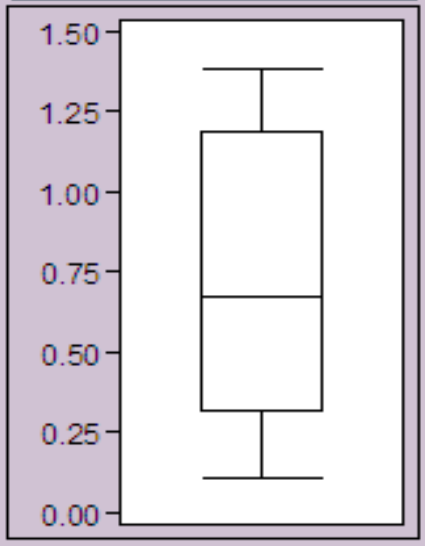
100.0%	maximum	0.119
99.5%		0.119
97.5%		0.119
90.0%		0.119
75.0%	quartile	0.115
50.0%	median	0.09
25.0%	quartile	0.068
10.0%		0.063
2.5%		0.063
0.5%		0.063
0.0%	minimum	0.063

Moments

Mean	0.091
Std Dev	0.025
Std Err Mean	0.01
Upper 95% Mean	0.117
Lower 95% Mean	0.065
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected



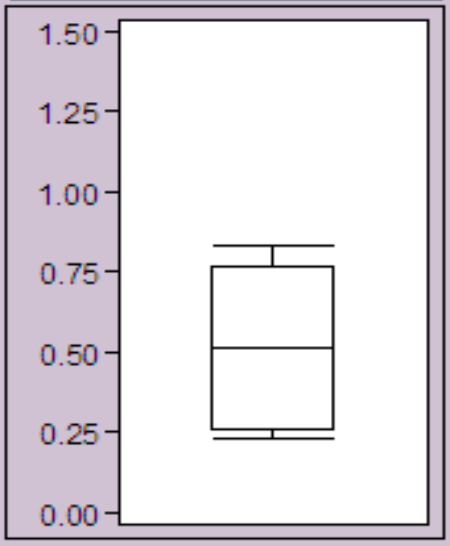
Quantiles

100.0%	maximum	1.385
99.5%		1.385
97.5%		1.385
90.0%		1.385
75.0%	quartile	1.187
50.0%	median	0.674
25.0%	quartile	0.318
10.0%		0.106
2.5%		0.106
0.5%		0.106
0.0%	minimum	0.106

Moments

Mean	0.725
Std Dev	0.468
Std Err Mean	0.191
Upper 95% Mean	1.216
Lower 95% Mean	0.233
N	6

Odor Detected



Quantiles

100.0%	maximum	0.831
99.5%		0.831
97.5%		0.831
90.0%		0.831
75.0%	quartile	0.768
50.0%	median	0.514
25.0%	quartile	0.262
10.0%		0.233
2.5%		0.233
0.5%		0.233
0.0%	minimum	0.233

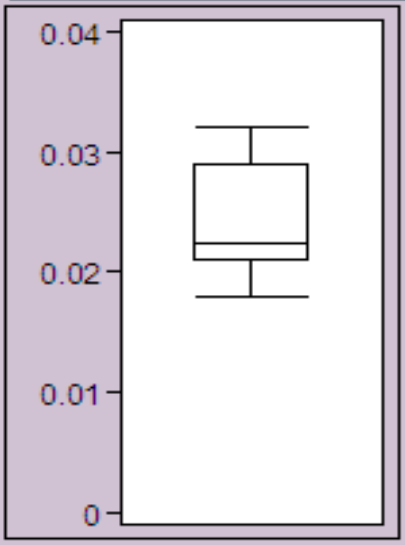
Moments

Mean	0.518
Std Dev	0.245
Std Err Mean	0.1
Upper 95% Mean	0.776
Lower 95% Mean	0.261
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Chloroform 67-66-3



Quantiles

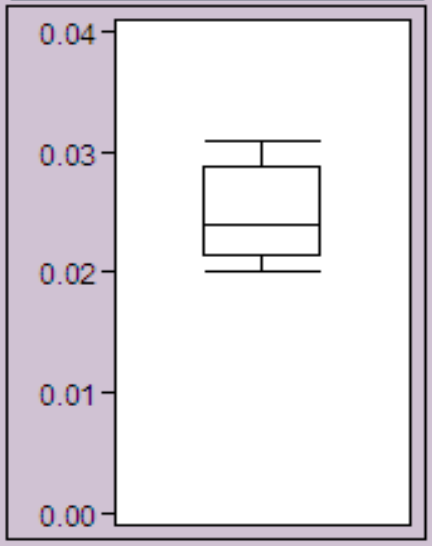
100.0%	maximum	0.032
99.5%		0.032
97.5%		0.032
90.0%		0.032
75.0%	quartile	0.029
50.0%	median	0.023
25.0%	quartile	0.021
10.0%		0.018
2.5%		0.018
0.5%		0.018
0.0%	minimum	0.018

Moments

Mean	0.024
Std Dev	0.005
Std Err Mean	0.002
Upper 95% Mean	0.029
Lower 95% Mean	0.019
N	6

Odor Detected

Chloroform 67-66-3



Quantiles

100.0%	maximum	0.031
99.5%		0.031
97.5%		0.031
90.0%		0.031
75.0%	quartile	0.029
50.0%	median	0.024
25.0%	quartile	0.022
10.0%		0.02
2.5%		0.02
0.5%		0.02
0.0%	minimum	0.02

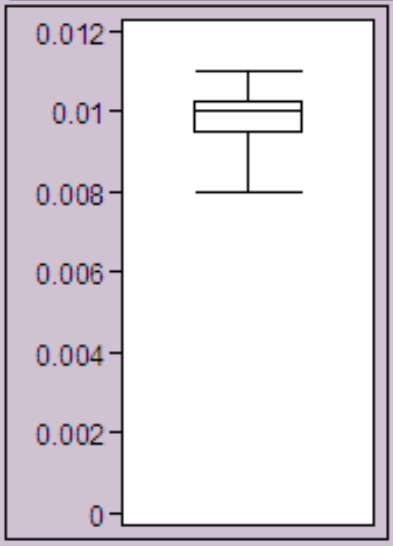
Moments

Mean	0.025
Std Dev	0.004
Std Err Mean	0.002
Upper 95% Mean	0.029
Lower 95% Mean	0.021
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Ethylene Dichloride 107-06-2



Quantiles

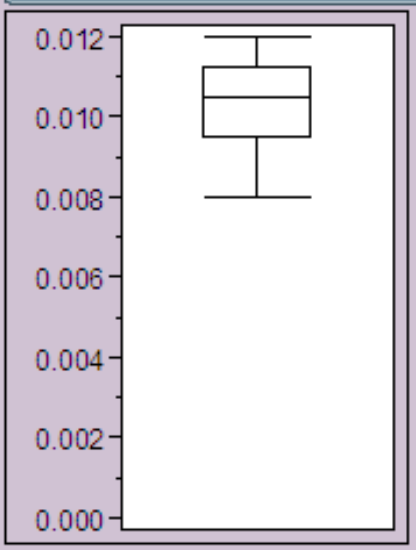
100.0%	maximum	0.011
99.5%		0.011
97.5%		0.011
90.0%		0.011
75.0%	quartile	0.01
50.0%	median	0.01
25.0%	quartile	0.01
10.0%		0.008
2.5%		0.008
0.5%		0.008
0.0%	minimum	0.008

Moments

Mean	0.0098
Std Dev	0.001
Std Err Mean	0.0004
Upper 95% Mean	0.0109
Lower 95% Mean	0.0088
N	6

Odor Detected

Ethylene Dichloride 107-06-2



Quantiles

100.0%	maximum	0.012
99.5%		0.012
97.5%		0.012
90.0%		0.012
75.0%	quartile	0.011
50.0%	median	0.011
25.0%	quartile	0.01
10.0%		0.008
2.5%		0.008
0.5%		0.008
0.0%	minimum	0.008

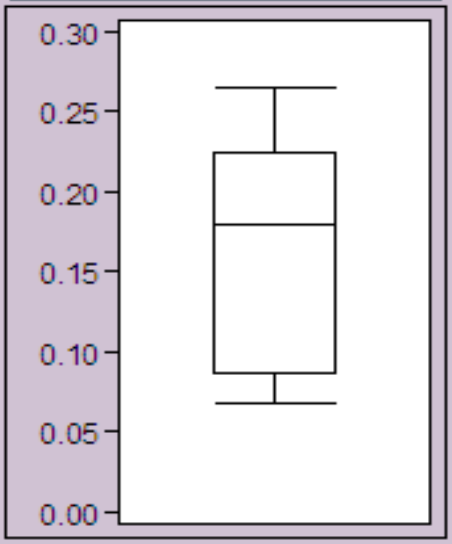
Moments

Mean	0.01
Std Dev	0.001
Std Err Mean	0.001
Upper 95% Mean	0.012
Lower 95% Mean	0.009
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Benzene 71-43-2



Quantiles

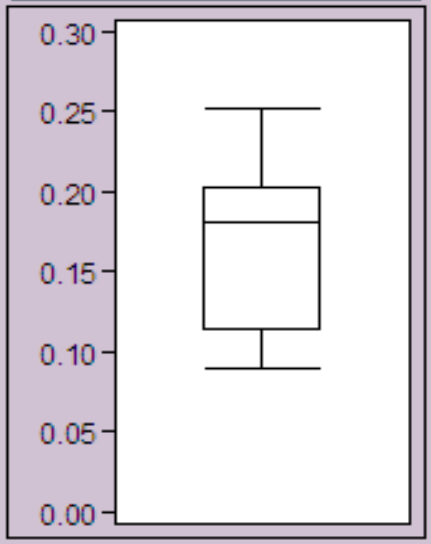
100.0%	maximum	0.265
99.5%		0.265
97.5%		0.265
90.0%		0.265
75.0%	quartile	0.225
50.0%	median	0.179
25.0%	quartile	0.087
10.0%		0.068
2.5%		0.068
0.5%		0.068
0.0%	minimum	0.068

Moments

Mean	0.166
Std Dev	0.074
Std Err Mean	0.03
Upper 95% Mean	0.243
Lower 95% Mean	0.088
N	6

Odor Detected

Benzene 71-43-2



Quantiles

100.0%	maximum	0.252
99.5%		0.252
97.5%		0.252
90.0%		0.252
75.0%	quartile	0.203
50.0%	median	0.181
25.0%	quartile	0.115
10.0%		0.09
2.5%		0.09
0.5%		0.09
0.0%	minimum	0.09

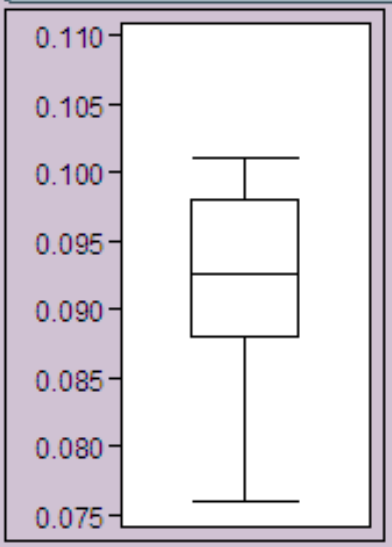
Moments

Mean	0.169
Std Dev	0.056
Std Err Mean	0.023
Upper 95% Mean	0.228
Lower 95% Mean	0.11
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Carbon Tetrachloride 56-23-5



Quantiles

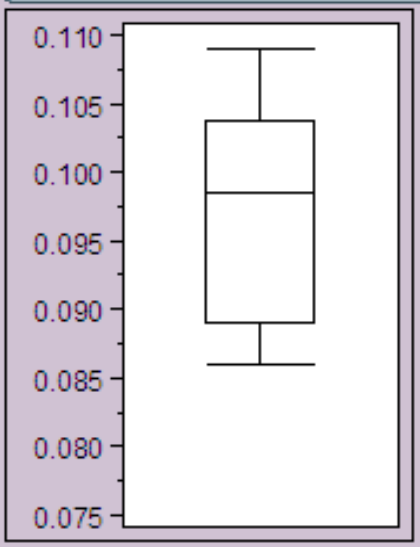
100.0%	maximum	0.101
99.5%		0.101
97.5%		0.101
90.0%		0.101
75.0%	quartile	0.098
50.0%	median	0.093
25.0%	quartile	0.088
10.0%		0.076
2.5%		0.076
0.5%		0.076
0.0%	minimum	0.076

Moments

Mean	0.092
Std Dev	0.009
Std Err Mean	0.003
Upper 95% Mean	0.101
Lower 95% Mean	0.083
N	6

Odor Detected

Carbon Tetrachloride 56-23-5



Quantiles

100.0%	maximum	0.109
99.5%		0.109
97.5%		0.109
90.0%		0.109
75.0%	quartile	0.104
50.0%	median	0.099
25.0%	quartile	0.089
10.0%		0.086
2.5%		0.086
0.5%		0.086
0.0%	minimum	0.086

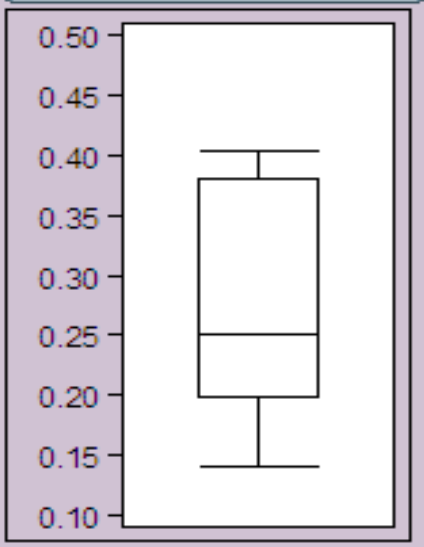
Moments

Mean	0.097
Std Dev	0.008
Std Err Mean	0.003
Upper 95% Mean	0.106
Lower 95% Mean	0.089
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Toluene 108-88-3



Quantiles

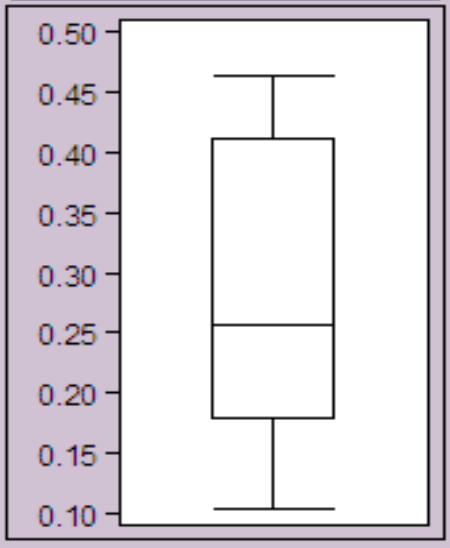
100.0%	maximum	0.404
99.5%		0.404
97.5%		0.404
90.0%		0.404
75.0%	quartile	0.38
50.0%	median	0.25
25.0%	quartile	0.199
10.0%		0.141
2.5%		0.141
0.5%		0.141
0.0%	minimum	0.141

Moments

Mean	0.273
Std Dev	0.1
Std Err Mean	0.041
Upper 95% Mean	0.377
Lower 95% Mean	0.168
N	6

Odor Detected

Toluene 108-88-3



Quantiles

100.0%	maximum	0.463
99.5%		0.463
97.5%		0.463
90.0%		0.463
75.0%	quartile	0.411
50.0%	median	0.257
25.0%	quartile	0.179
10.0%		0.103
2.5%		0.103
0.5%		0.103
0.0%	minimum	0.103

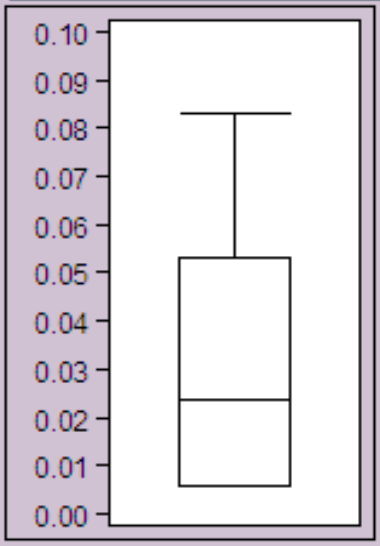
Moments

Mean	0.28
Std Dev	0.131
Std Err Mean	0.054
Upper 95% Mean	0.417
Lower 95% Mean	0.142
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Tetrachloroethylene 127-18-4



Quantiles

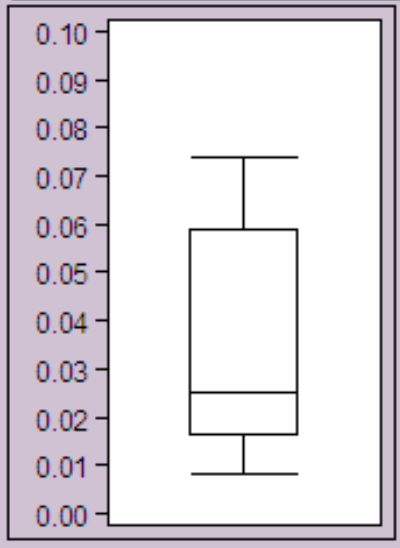
100.0%	maximum	0.083
99.5%		0.083
97.5%		0.083
90.0%		0.083
75.0%	quartile	0.053
50.0%	median	0.024
25.0%	quartile	0.006
10.0%		0.006
2.5%		0.006
0.5%		0.006
0.0%	minimum	0.006

Moments

Mean	0.0308
Std Dev	0.0299
Std Err Mean	0.0122
Upper 95% Mean	0.0622
Lower 95% Mean	-0.001
N	6

Odor Detected

Tetrachloroethylene 127-18-4



Quantiles

100.0%	maximum	0.074
99.5%		0.074
97.5%		0.074
90.0%		0.074
75.0%	quartile	0.059
50.0%	median	0.025
25.0%	quartile	0.016
10.0%		0.008
2.5%		0.008
0.5%		0.008
0.0%	minimum	0.008

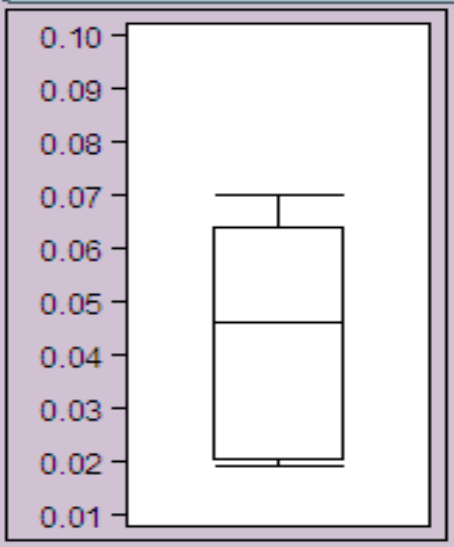
Moments

Mean	0.034
Std Dev	0.025
Std Err Mean	0.01
Upper 95% Mean	0.06
Lower 95% Mean	0.008
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected

Ethylbenzene 100-41-4



Quantiles

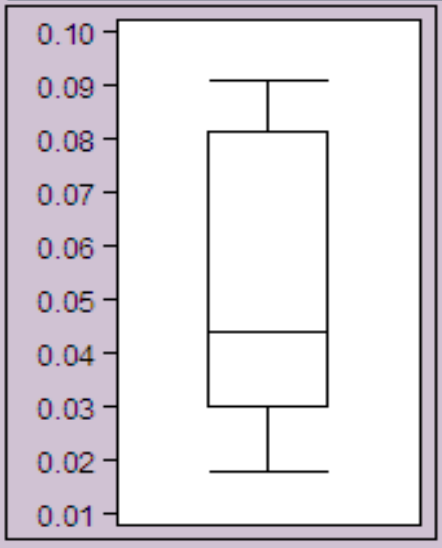
100.0%	maximum	0.07
99.5%		0.07
97.5%		0.07
90.0%		0.07
75.0%	quartile	0.064
50.0%	median	0.046
25.0%	quartile	0.021
10.0%		0.019
2.5%		0.019
0.5%		0.019
0.0%	minimum	0.019

Moments

Mean	0.044
Std Dev	0.022
Std Err Mean	0.009
Upper 95% Mean	0.067
Lower 95% Mean	0.021
N	6

Odor Detected

Ethylbenzene 100-41-4



Quantiles

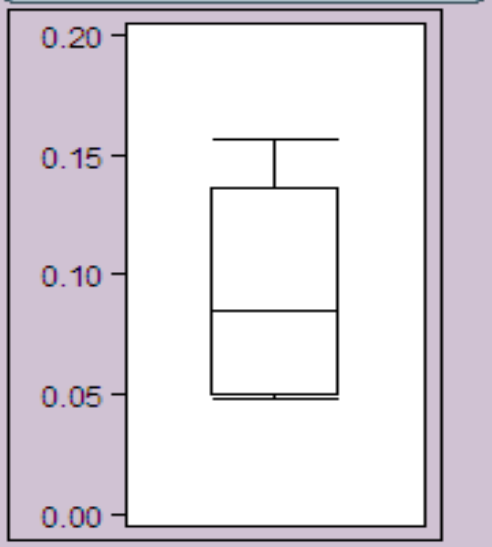
100.0%	maximum	0.091
99.5%		0.091
97.5%		0.091
90.0%		0.091
75.0%	quartile	0.081
50.0%	median	0.044
25.0%	quartile	0.03
10.0%		0.018
2.5%		0.018
0.5%		0.018
0.0%	minimum	0.018

Moments

Mean	0.052
Std Dev	0.028
Std Err Mean	0.011
Upper 95% Mean	0.081
Lower 95% Mean	0.022
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected



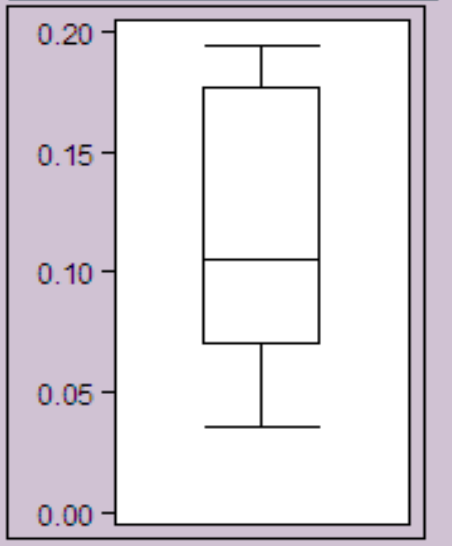
Quantiles

100.0%	maximum	0.157
99.5%		0.157
97.5%		0.157
90.0%		0.157
75.0%	quartile	0.136
50.0%	median	0.086
25.0%	quartile	0.05
10.0%		0.048
2.5%		0.048
0.5%		0.048
0.0%	minimum	0.048

Moments

Mean	0.093
Std Dev	0.046
Std Err Mean	0.019
Upper 95% Mean	0.141
Lower 95% Mean	0.045
N	6

Odor Detected



Quantiles

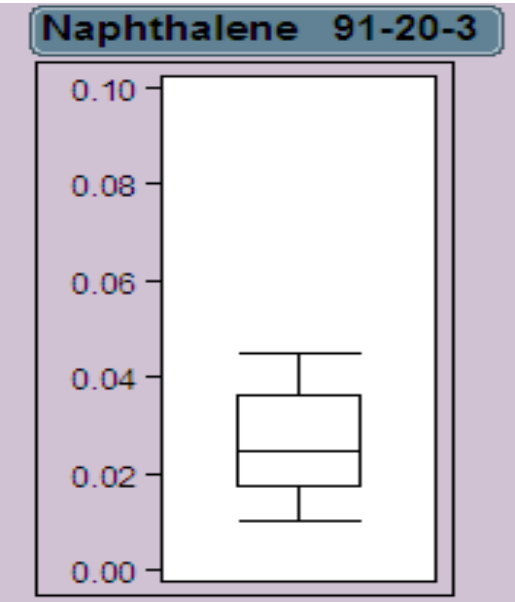
100.0%	maximum	0.194
99.5%		0.194
97.5%		0.194
90.0%		0.194
75.0%	quartile	0.177
50.0%	median	0.106
25.0%	quartile	0.071
10.0%		0.036
2.5%		0.036
0.5%		0.036
0.0%	minimum	0.036

Moments

Mean	0.116
Std Dev	0.059
Std Err Mean	0.024
Upper 95% Mean	0.177
Lower 95% Mean	0.054
N	6

HAPs Grab Sample Summary
Grandview Neighborhood and Vicinity, Augusta Maine
12 Samples Obtained between July 7 and October 20, 2010

No Odor Detected



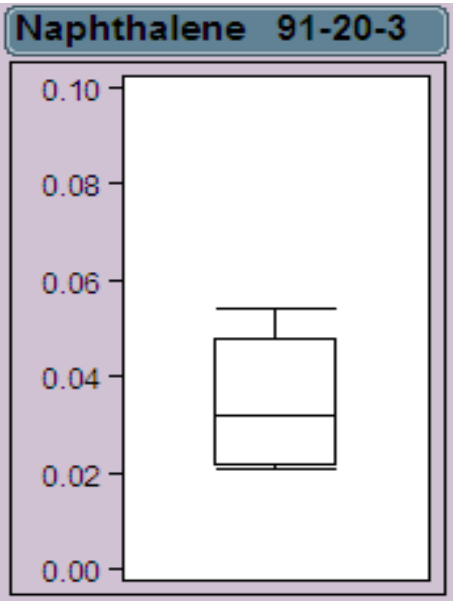
Quantiles

100.0%	maximum	0.045
99.5%		0.045
97.5%		0.045
90.0%		0.045
75.0%	quartile	0.036
50.0%	median	0.025
25.0%	quartile	0.018
10.0%		0.01
2.5%		0.01
0.5%		0.01
0.0%	minimum	0.01

Moments

Mean	0.026
Std Dev	0.012
Std Err Mean	0.005
Upper 95% Mean	0.039
Lower 95% Mean	0.014
N	6

Odor Detected



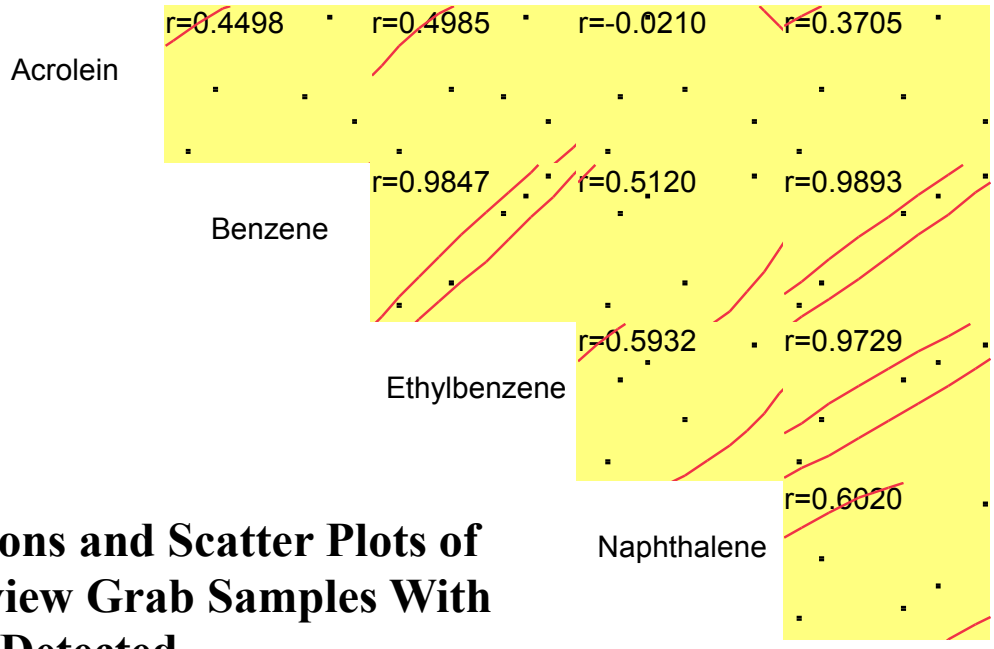
Quantiles

100.0%	maximum	0.054
99.5%		0.054
97.5%		0.054
90.0%		0.054
75.0%	quartile	0.048
50.0%	median	0.032
25.0%	quartile	0.022
10.0%		0.021
2.5%		0.021
0.5%		0.021
0.0%	minimum	0.021

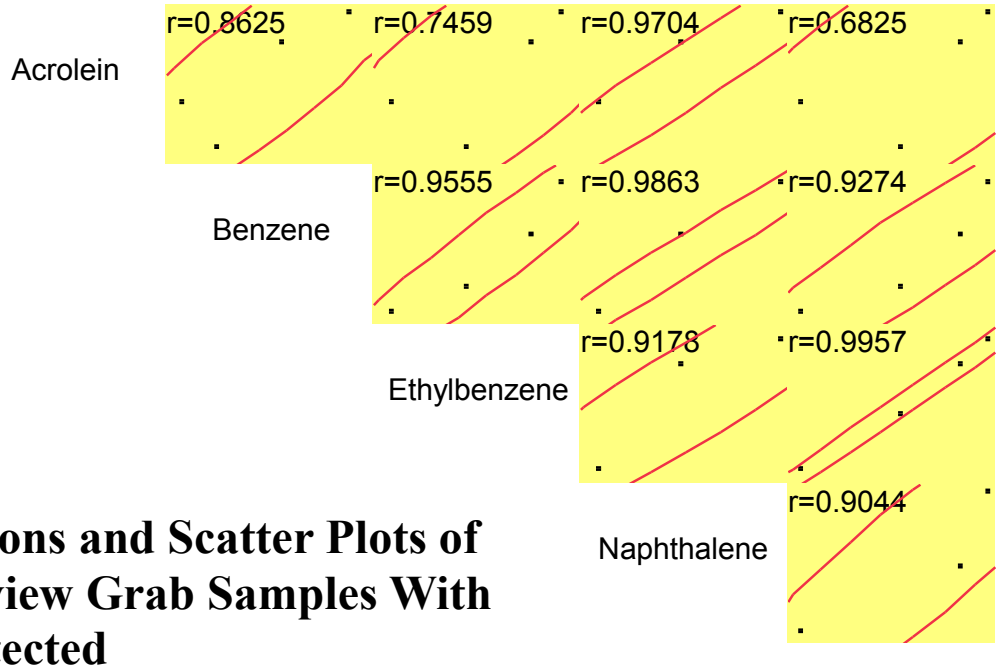
Moments

Mean	0.034
Std Dev	0.014
Std Err Mean	0.006
Upper 95% Mean	0.052
Lower 95% Mean	0.017
N	5

Appendix B



Correlations and Scatter Plots of 5 Grandview Grab Samples With No Odor Detected 7/7—9/22/2010



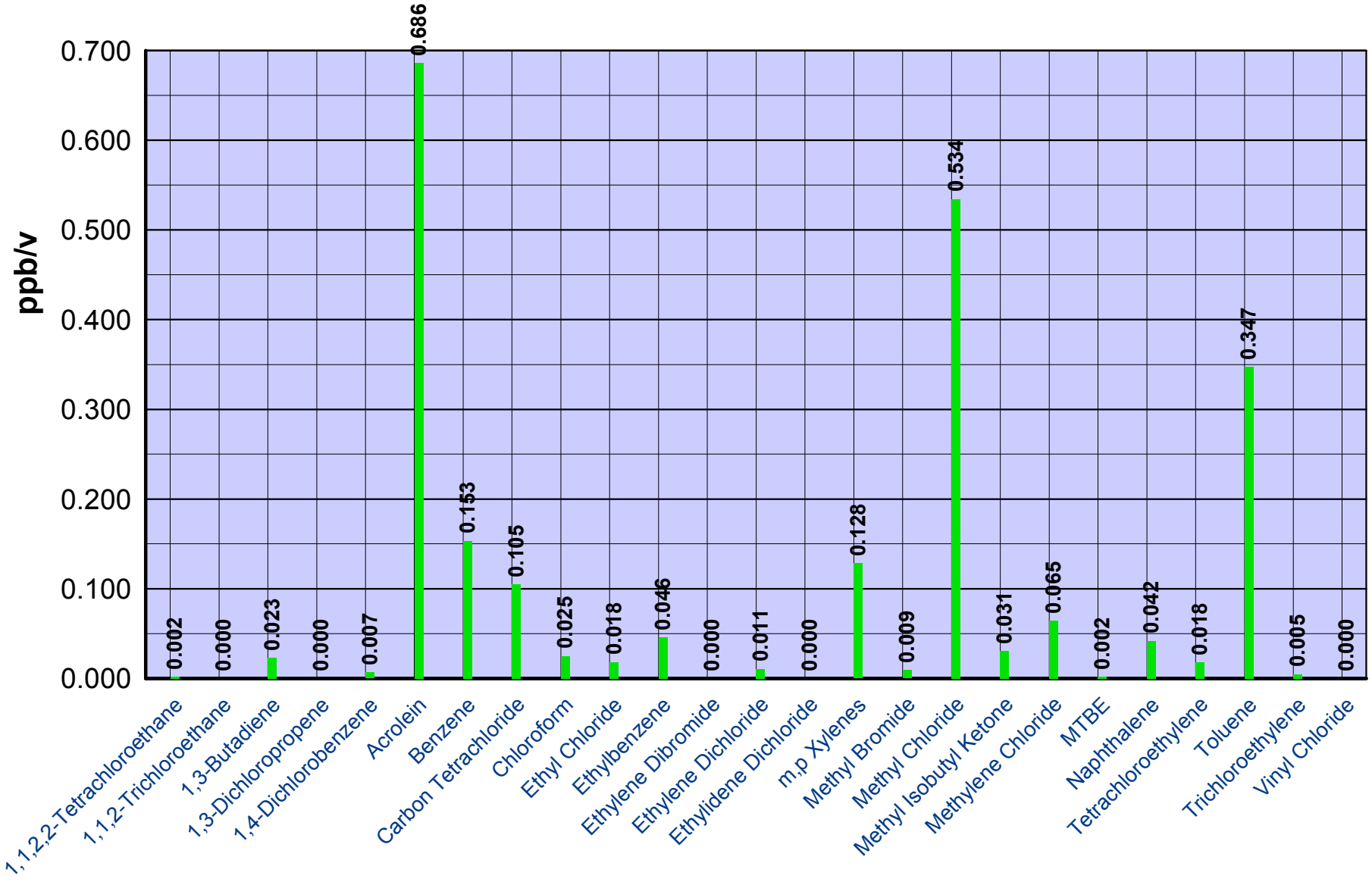
Correlations and Scatter Plots of 4 Grandview Grab Samples With Odor Detected 7/7—9/22/2010

Appendix C

Ambient Concentration "Fingerprints"

For Bangor

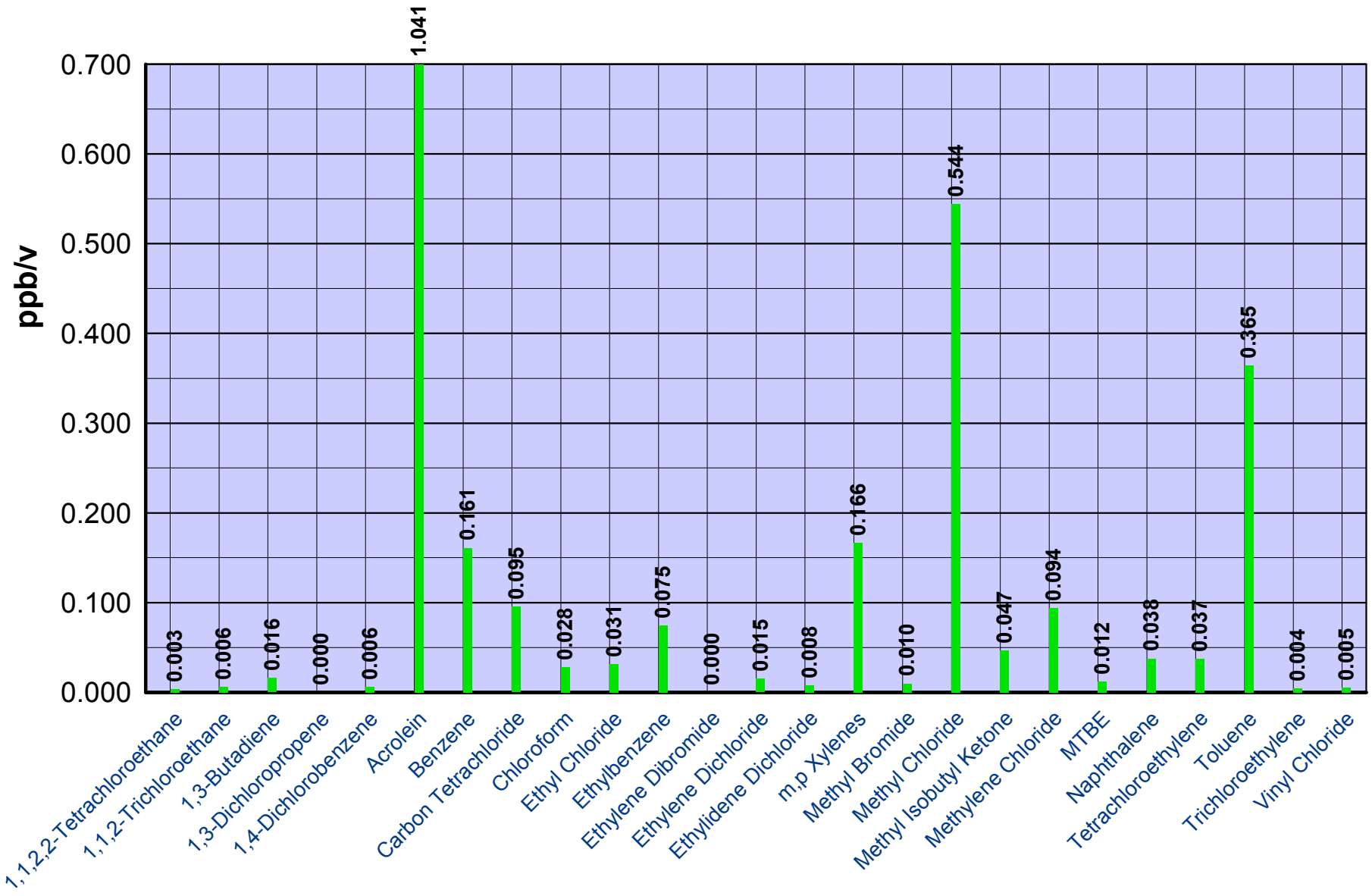
HAPs Averages From 07/07/2010 to 10/20/2010



Ambient Concentration "Fingerprints"

For Lewiston

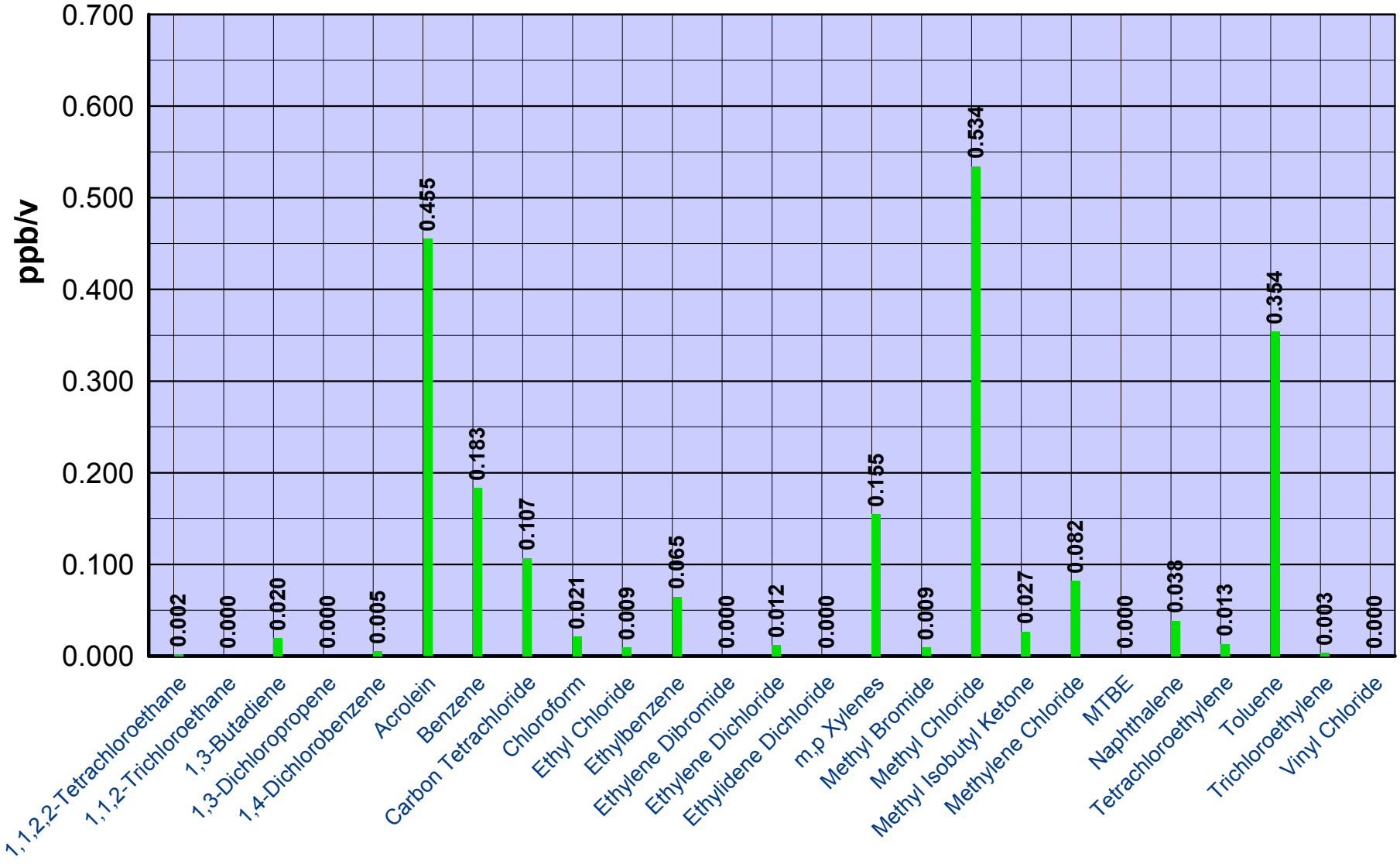
HAPs Averages From 07/07/2010 to 10/20/2010



Ambient Concentration "Fingerprints"

For Portland

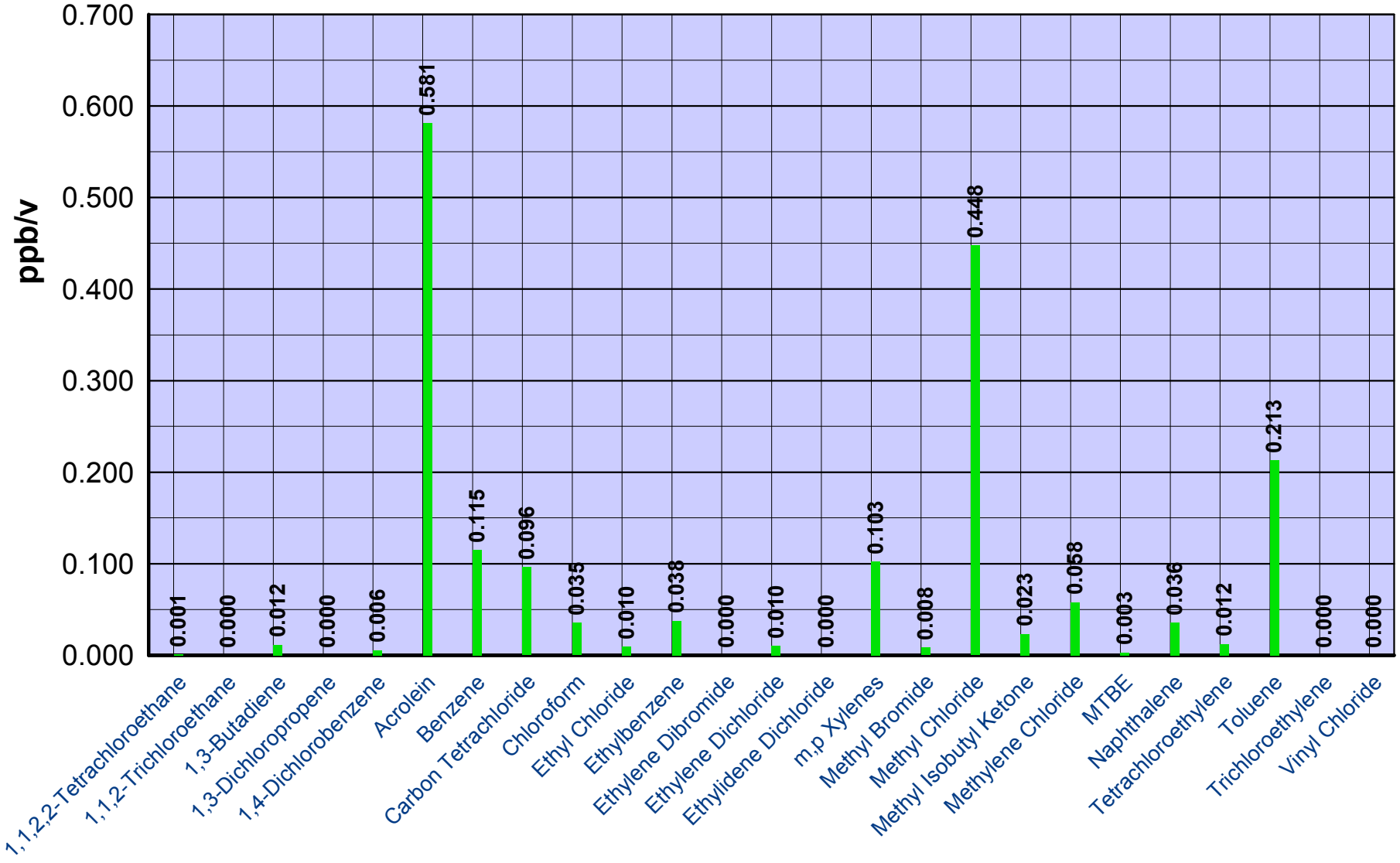
HAPs Averages From 07/07/2010 to 10/20/2010



Ambient Concentration "Fingerprints"

For Presque Isle

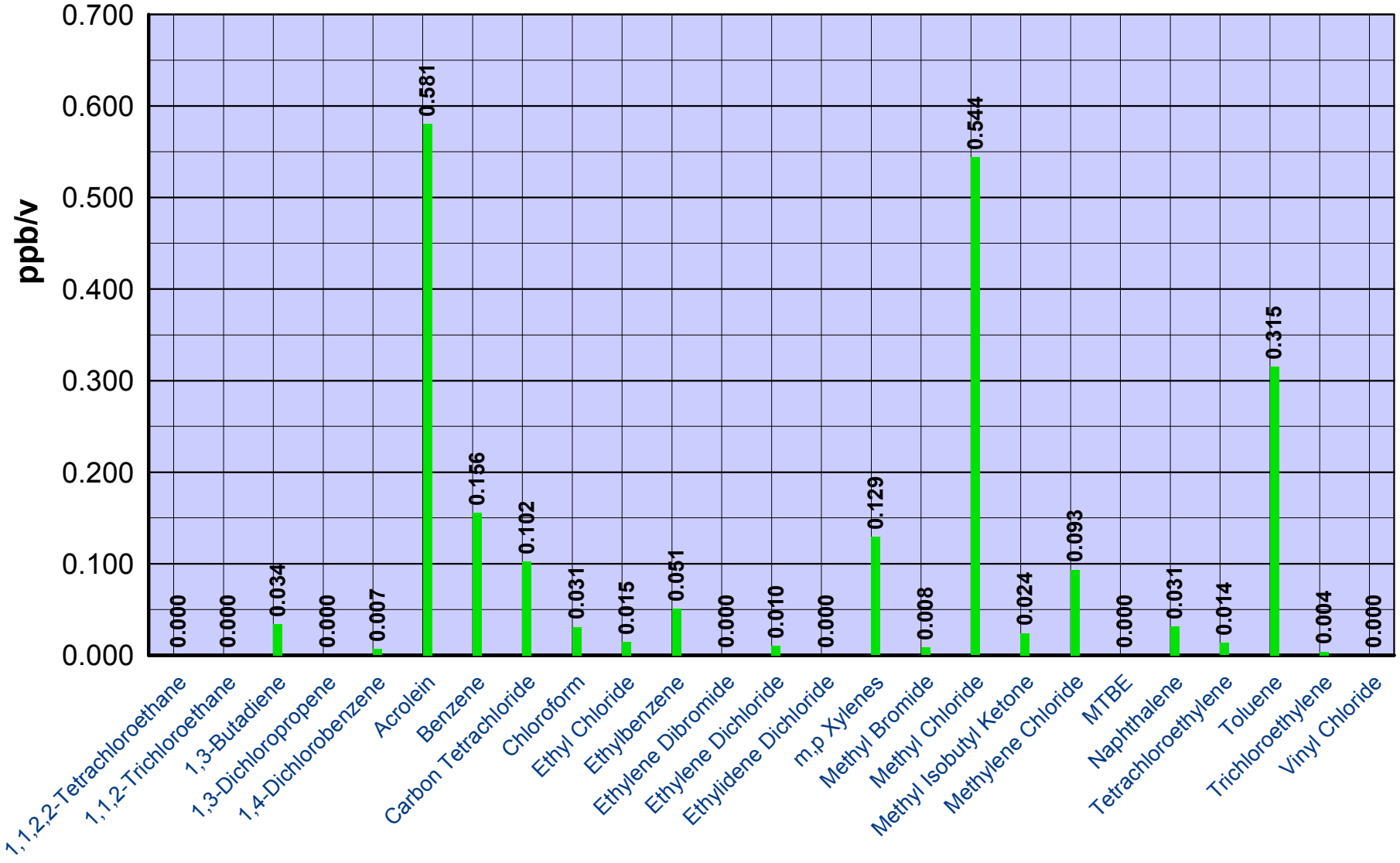
HAPs Averages From 07/07/2010 to 10/20/2010



Ambient Concentration "Fingerprints"

For Rumford

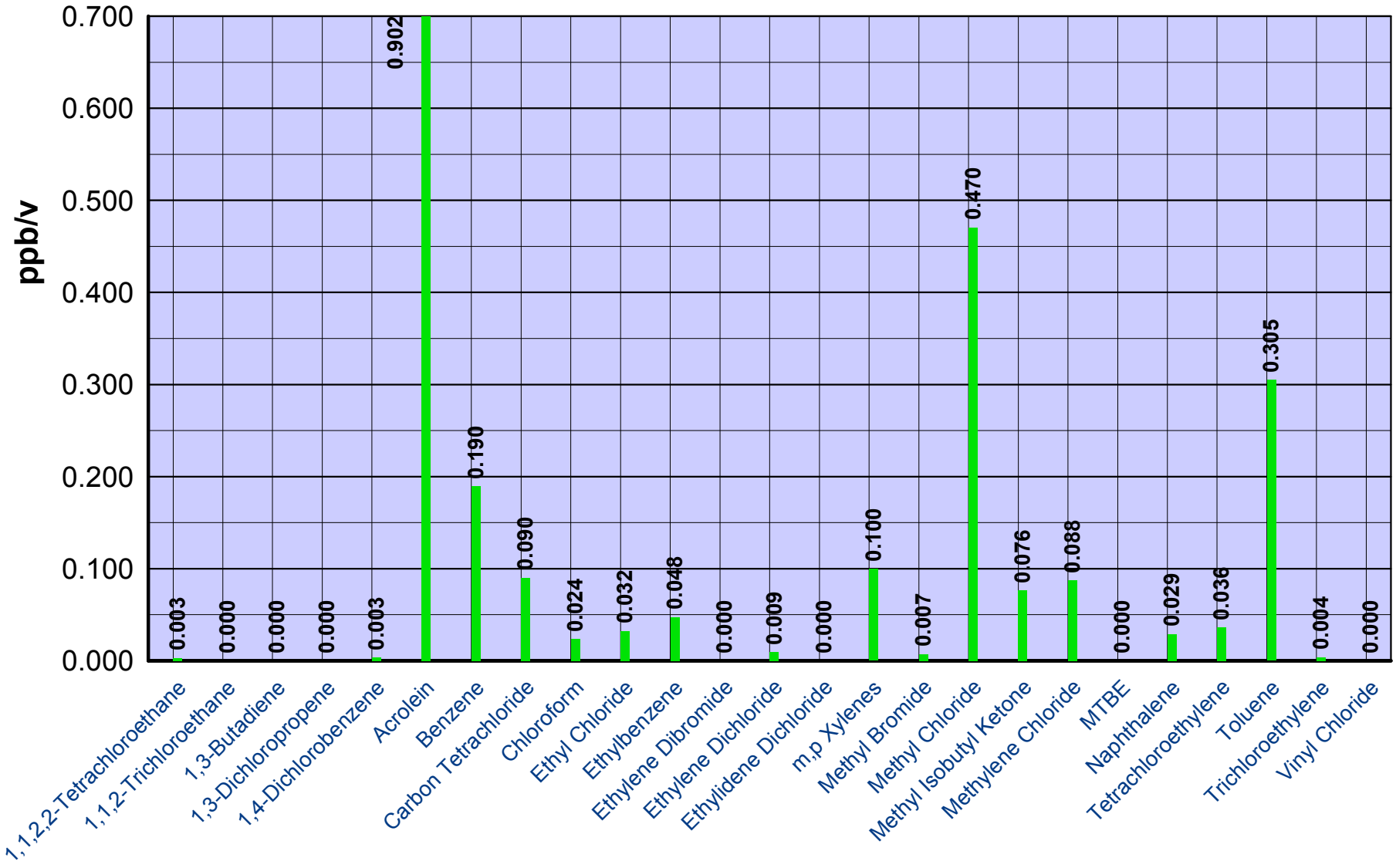
HAPs Averages From 07/07/2010 to 10/20/2010



Ambient Concentration "Fingerprints"

For Augusta Background Site

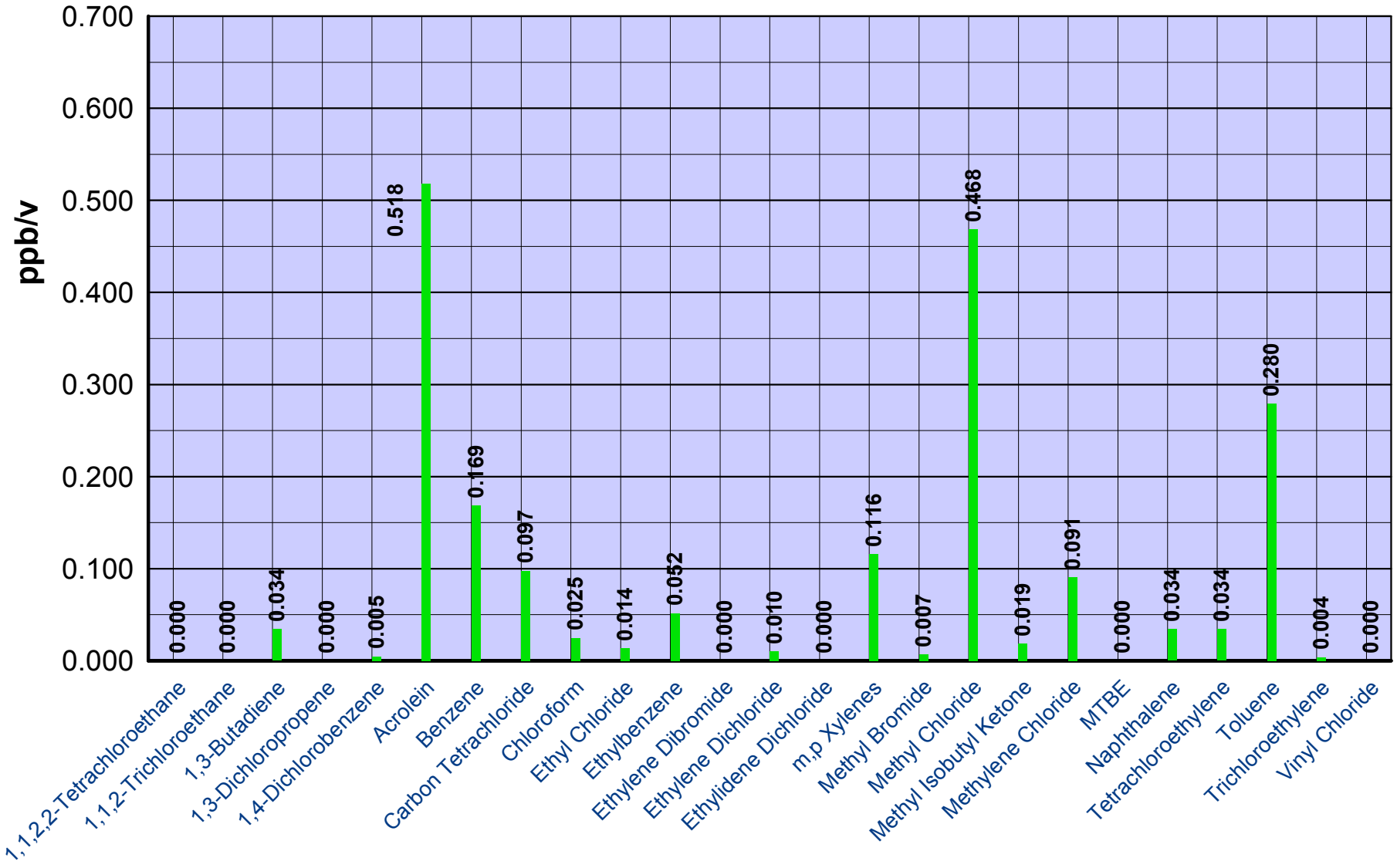
HAPs Averages From 07/01/2010 to 10/20/2010



Ambient Concentration "Fingerprints"

For Grandview Neighborhood Samples With Asphalt Odor Present

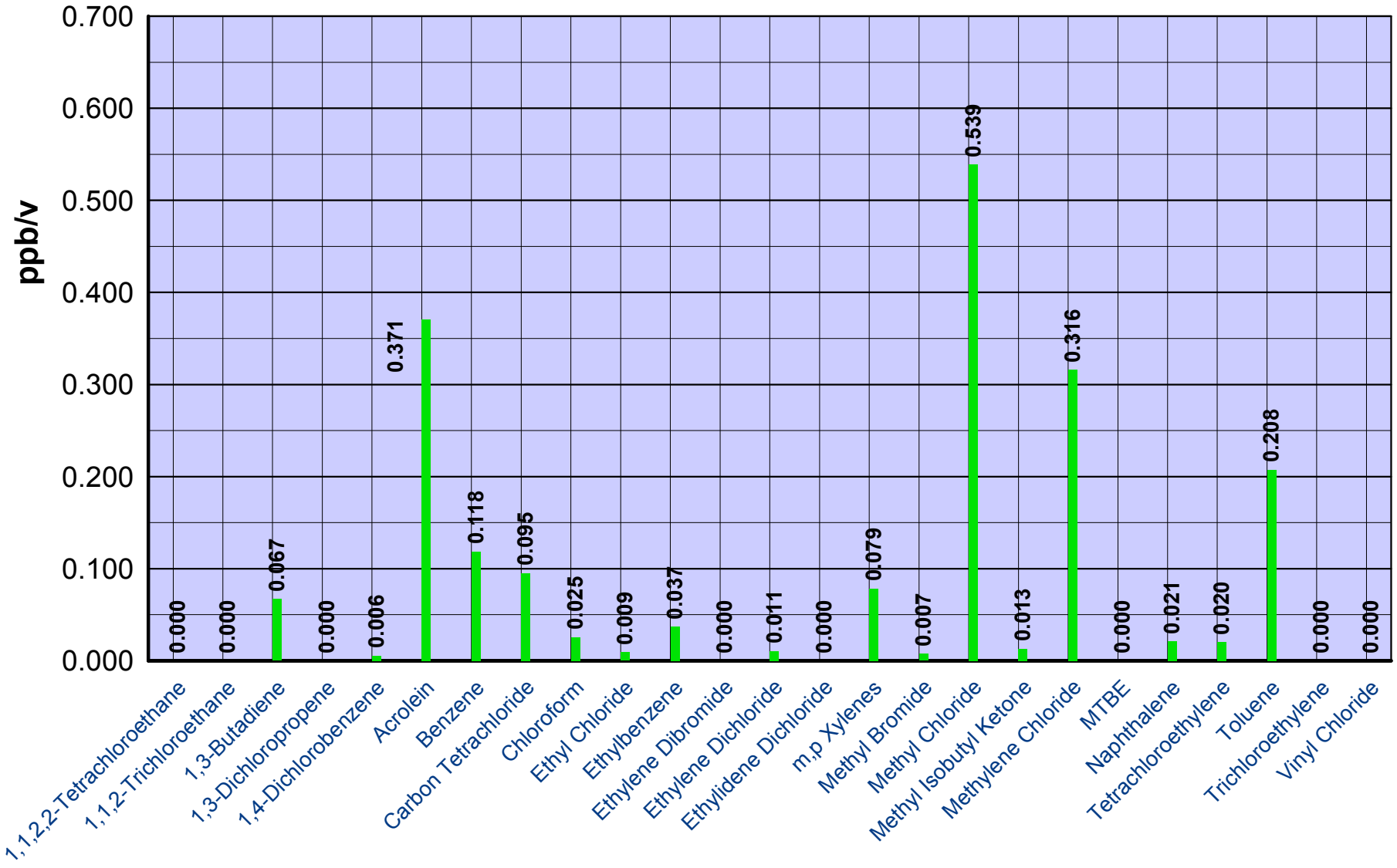
HAPs Averages From 07/01/2010 to 10/20/2010



Ambient Concentration "Fingerprints"

For Grandview Neighborhood Samples With No Odor Noted

HAPs Averages From 07/01/2010 to 10/20/2010

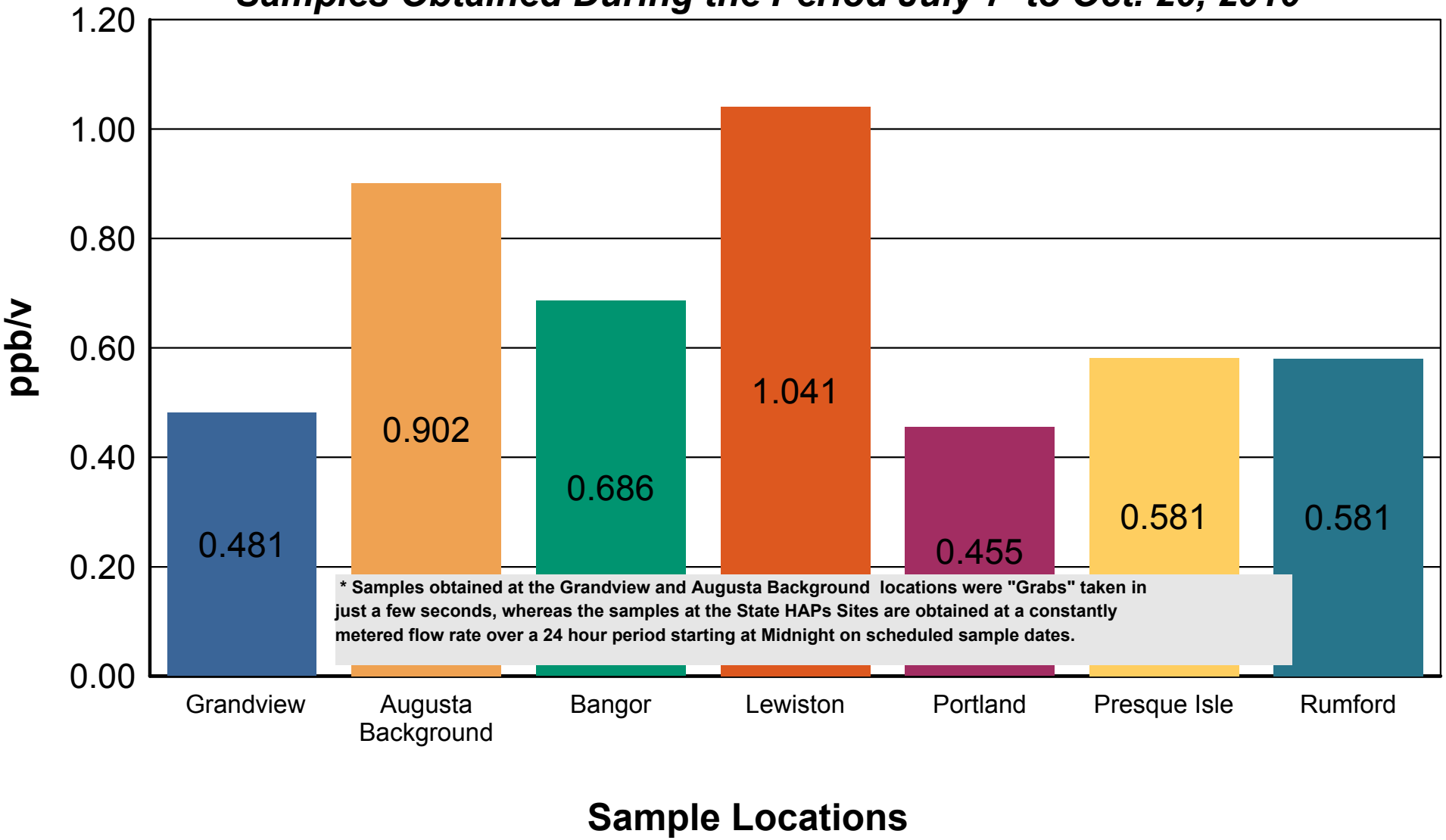


Appendix D

Average Concentrations

For Acrolein

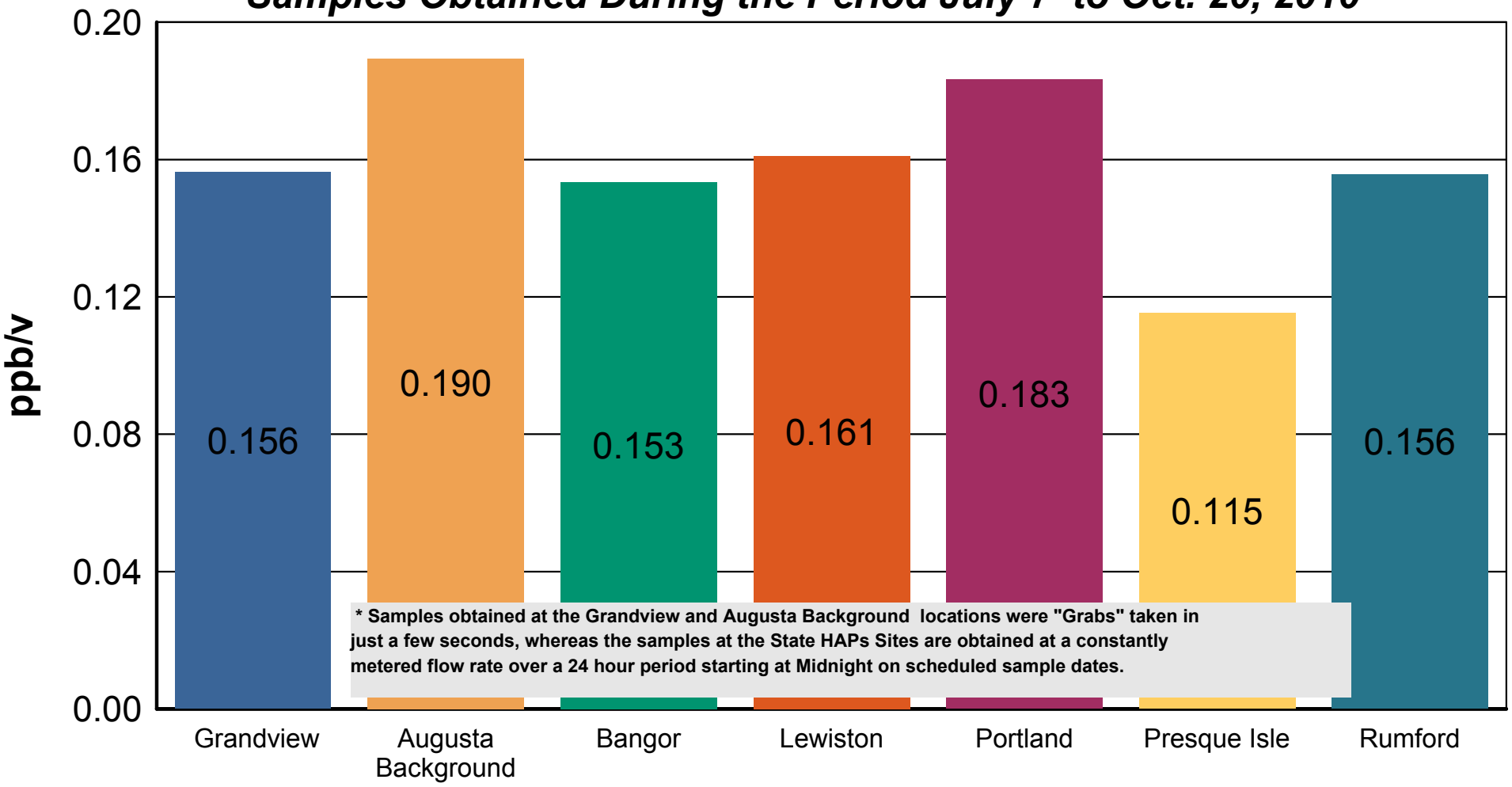
Samples Obtained During the Period July 7 to Oct. 20, 2010



Average Concentrations

For Benzene

Samples Obtained During the Period July 7 to Oct. 20, 2010

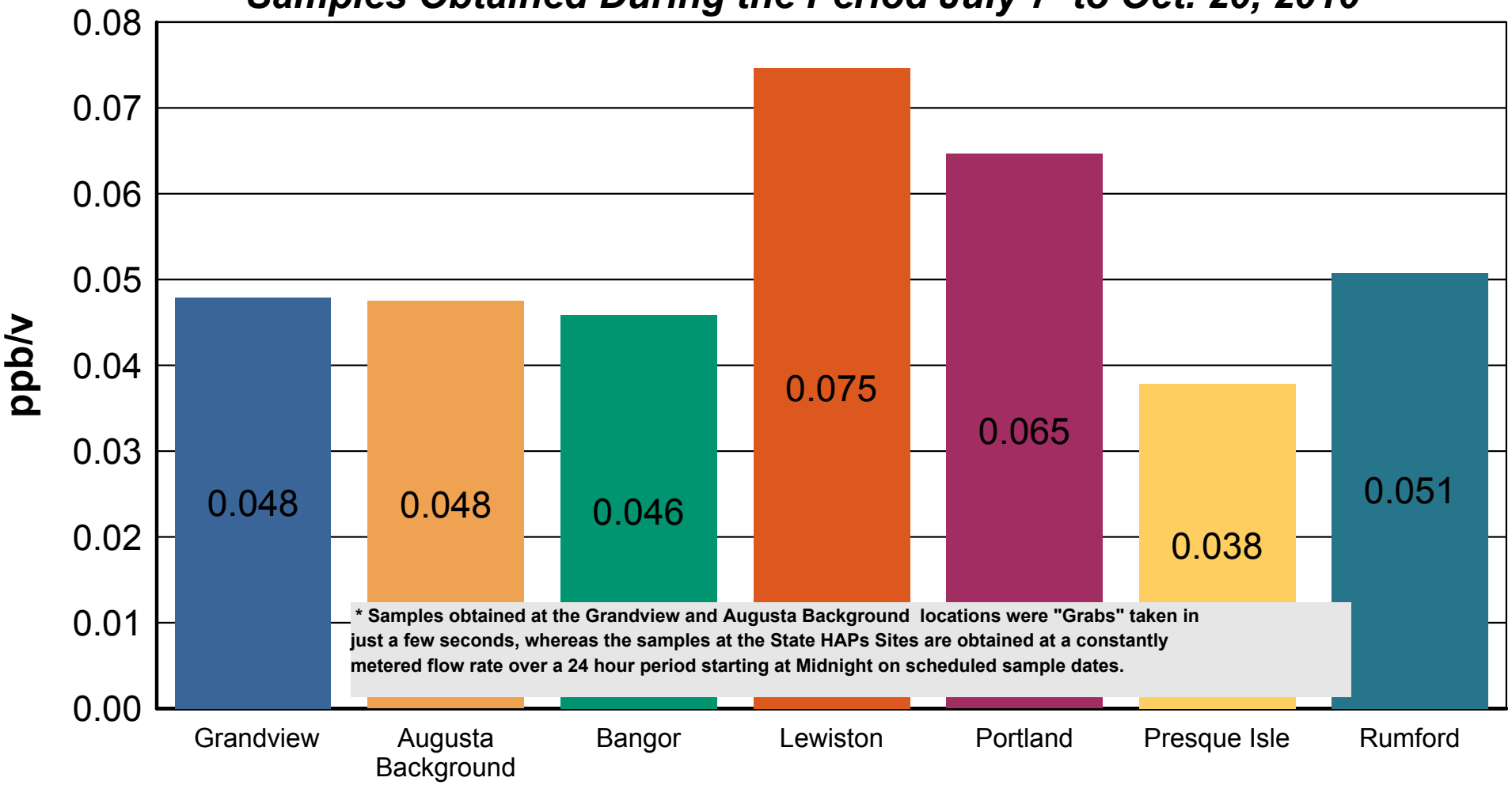


Sample Locations

Average Concentrations

For Ethylbenzene

Samples Obtained During the Period July 7 to Oct. 20, 2010

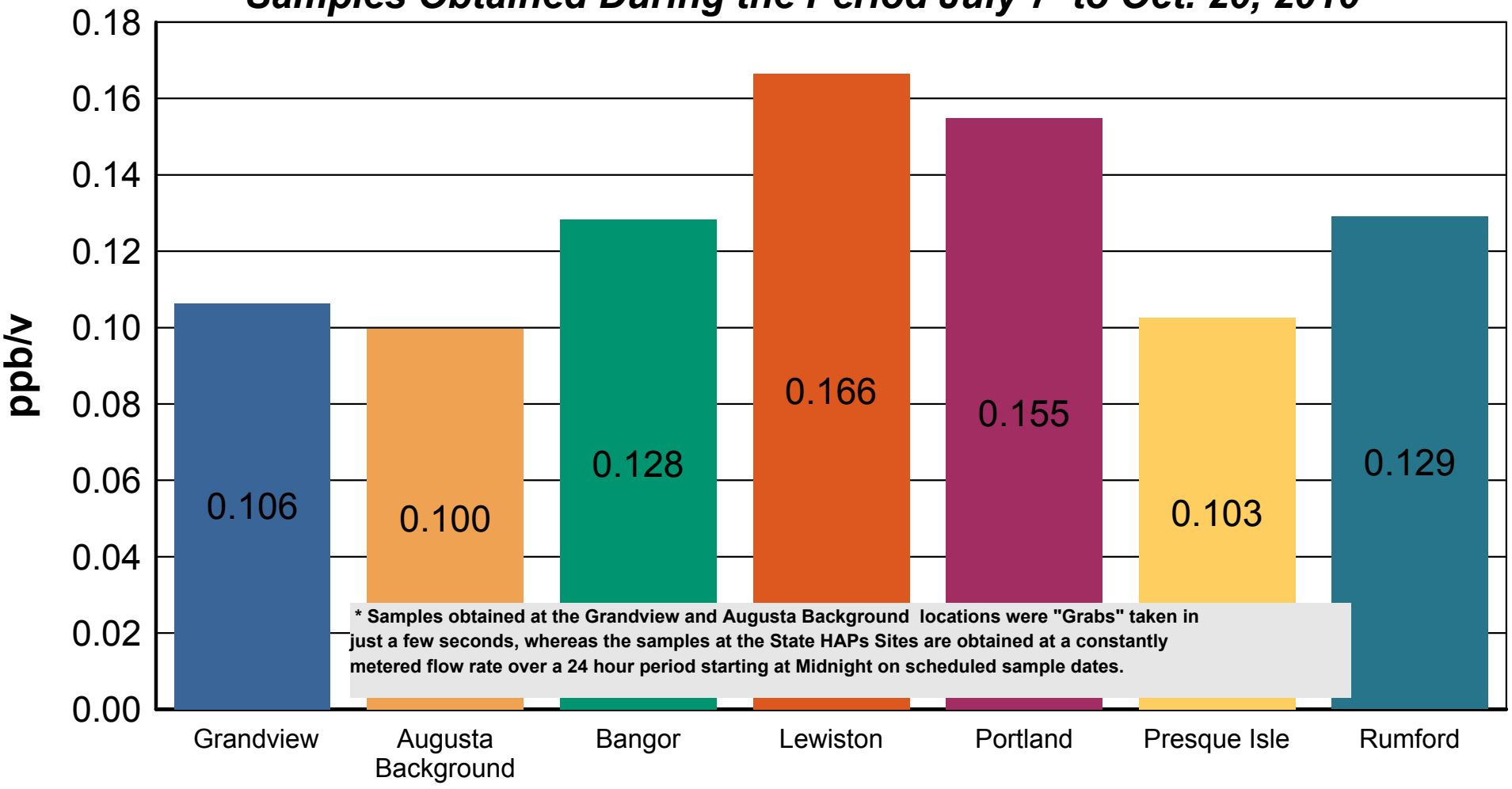


Sample Locations

Average Concentrations

For m,p Xylenes

Samples Obtained During the Period July 7 to Oct. 20, 2010

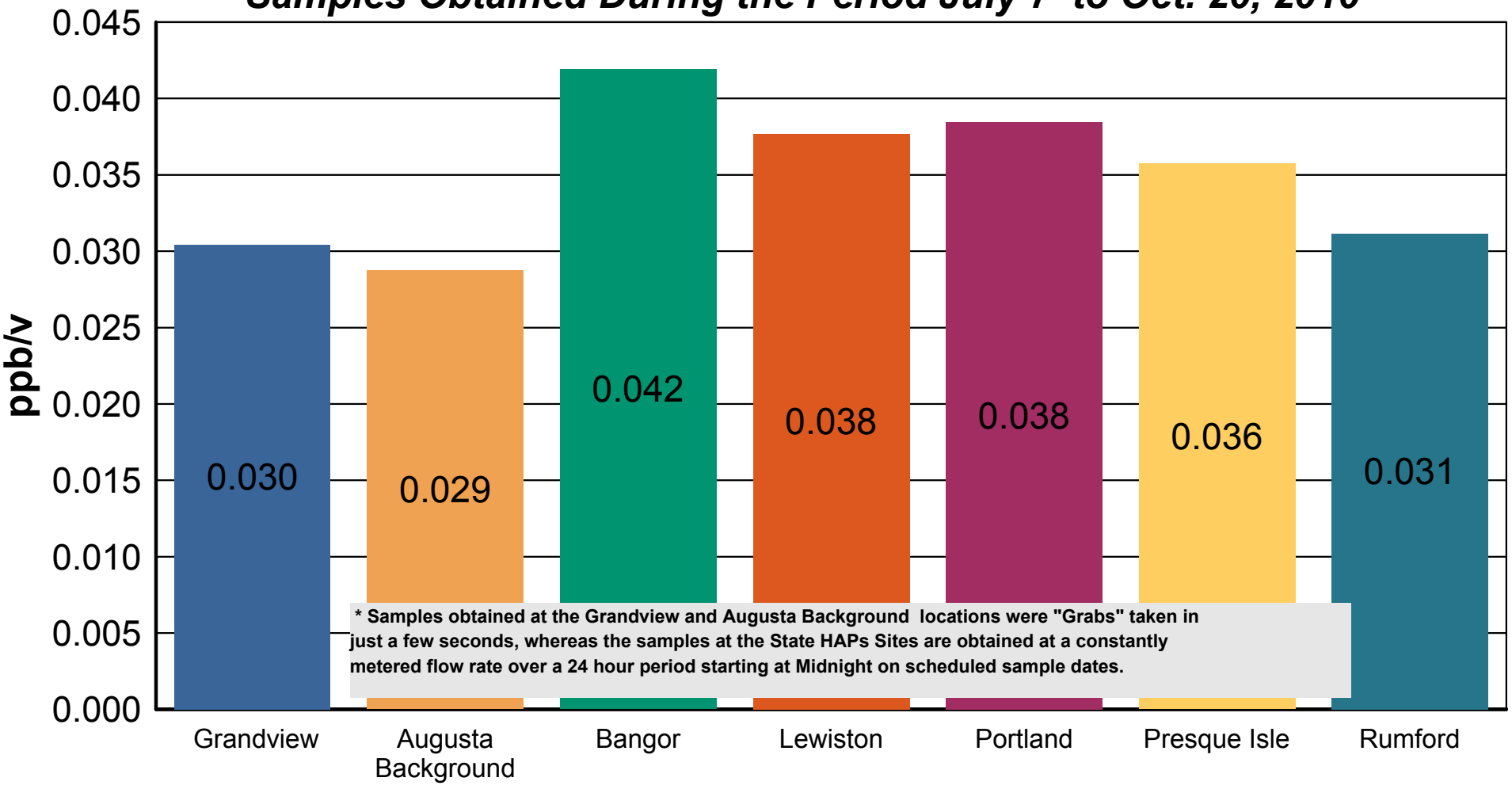


Sample Locations

Average Concentrations

For Naphthalene

Samples Obtained During the Period July 7 to Oct. 20, 2010

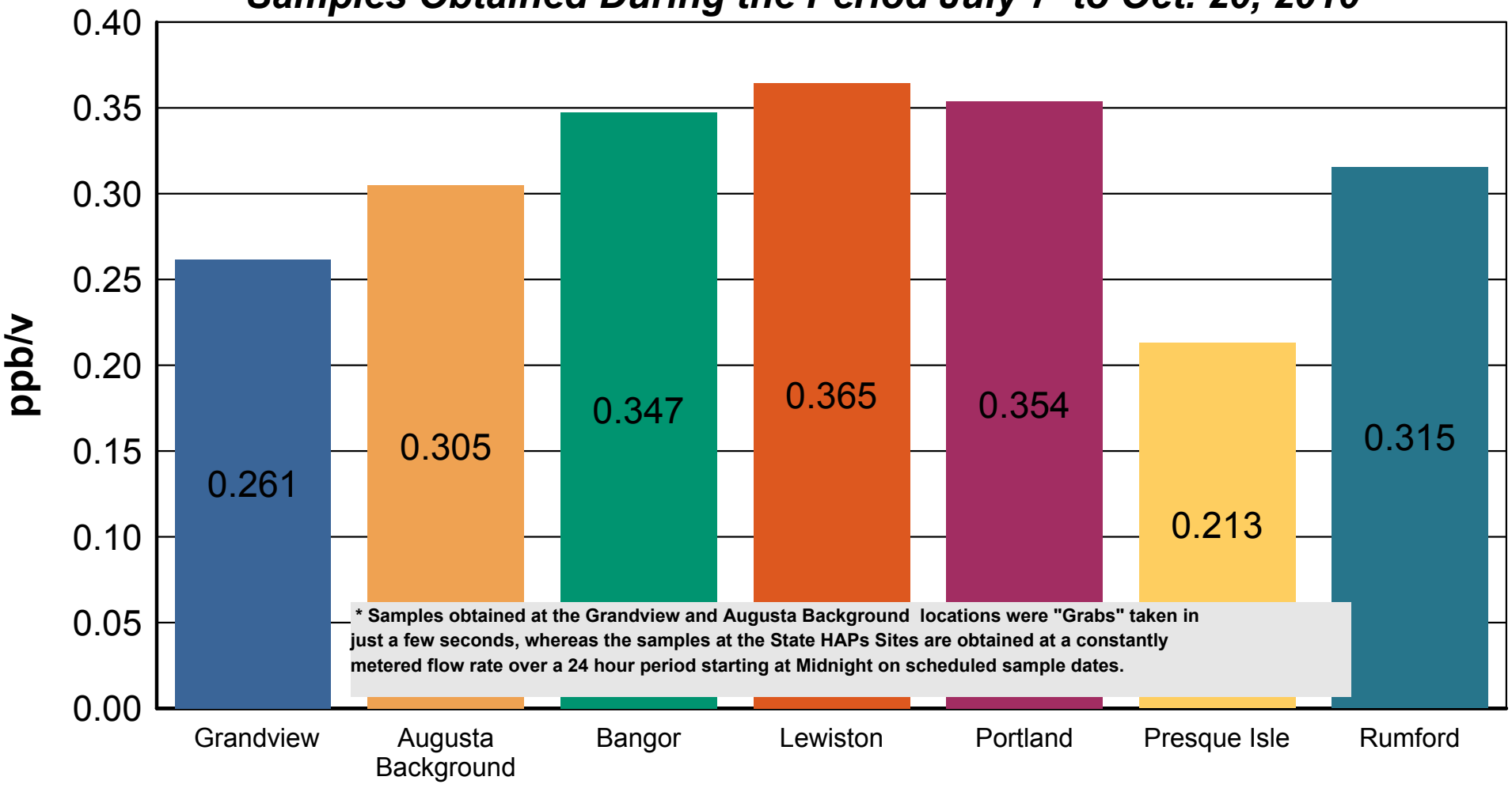


Sample Locations

Average Concentrations

For Toluene

Samples Obtained During the Period July 7 to Oct. 20, 2010



Sample Locations